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LETTER OF TRANSMISSION

I have the honor to submit herewith Volume VII of the history of the MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. The volume submitted is entitled, "TRAINING."

M. W. IRELAND,
Major General, the Surgeon General.

The SECRETARY OF WAR.

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^a The highest rank held during the World War has been used in the case of each officer.

PREFACE

This volume, comprising two sections, deals, in the first section, with the basic and special training which was given the various kinds of personnel making up the Medical Department in the United States, and, in the second section, with training in the American Expeditionary Forces.

Obviously, it is impossible to give herein all the details concerning the various schools. In many instances, as in the case of the special schools for medical officers in the United States, schedules of the courses of instruction have had to suffice.

As regards the work carried on at the Army Sanitary School, A. E. F., much of this was preserved in the form of mimeographed memoranda which had been prepared with the view of having them not only for lecture purposes at the school, but also for disseminating them to those members of the Medical Department, A. E. F., who, by reason of exigencies of the service, could not attend the courses at the school. A selection of these memoranda comprises the appendix to this volume. Many of them originally were illustrated. These illustrations have not been reproduced herein; however, great use has been made of them elsewhere, notably, in the volume on sanitation.

In the compilation of this volume, much assistance was rendered by Maj. William B. Borden, M. C., especially in respect of chapters dealing with training in special schools and with training in the American Expeditionary Forces. For this assistance, grateful acknowledgment is now made.

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INTRODUCTION

When the United States entered the war there were on duty in the Medical Department 491 Regular medical officers, 342 temporary officers, 86 officers of the Dental Corps, and 62 veterinary officers.¹ The actual strength of the enlisted men of the Medical Department was 6,619,² many of whom were new men, authorized by the national defense act of June 3, 1916. It was considered that 10 medical officers and 100 enlisted men of the Medical Department per 1,000 men of the Army was a necessary allowance in war time,³ and, as these proportions were authorized by the President, it promptly became apparent that the Regular personnel would not make even a complete skeleton for the great numbers of Medical Department personnel which would be necessary for an army of two or three million men. The balance of the body would have to come directly from civil life, and was untrained in military matters, and largely ignorant of its place and functions in a military machine.

While the principles of medicine and surgery and the facts of science are the same for military as for civil life and practice, the whole environment of military life is so different from that of civil life, the methods of procedure necessary for the proper functioning of a great organization are so different from those of the individual and individualistic physicians, the dealing with men in masses and as soldiers is an affair so different from dealing with individual sick civilians, that the well-trained and well-equipped civilian physician or surgeon might stand almost useless and helpless, even in time of great need, unless helped to fit into the military machinery and trained to be a member of the team.

The situation was somewhat similar with respect to enlisted men. They had to be soldiers, and soldiers with special training in technical work—nursing, office work, hospital work, etc. They could not be expected to arrive from civil life with this training; yet the work of the Medical Department was increased with the addition to the Army of each new man. He had to be examined carefully, vaccinated, and cared for when sick, and proper records had to be made in regard to him.

It was planned, therefore, to open training camps and schools for commissioned and enlisted personnel of the Medical Department in the United States; to provide for the continuance, overseas, of the training begun at home; and to make possible the completion of the professional education of medical, dental, and veterinary students in the schools in which they were enrolled when drafted for service in the Army.

The steps in the accomplishment of this plan, as it concerned Medical Department personnel, are given in the chapters which follow. A discussion of the provisions for an enlisted reserve corps representing the professional schools may be found in Volume I of this history (pp. 160 et seq.).

REFERENCES

- (1) Weekly Reports, Personnel Division, S. G. O., On file, Record Room, S. G. O. Weekly Report File. Also: Surgeon General's Annual Report, 1919, Vol. II, 1111.
- (2) Annual Report of the Surgeon General, United States Army, 1919, Vol. II, 1111.
- (3) Memorandum from the Surgeon General of the Army to Senator Chamberlain, September 20, 1917. Subject: Preparation for war of the Medical Department of the Army. On file, Record Room, S. G. O., 321.6 (Medical Department. Also: letter from the Surgeon General of the Army to The Adjutant General of the Army, May 21, 1917. Subject: Increase of the enlisted personnel, Medical Department. First indorsement thereon, The Adjutant General's Office, June 15, 1917. On file, Record Room, S. G. O. 128732-T (Old Files).

SECTION I
IN THE UNITED STATES
CHAPTER I
PLAN AND DEVELOPMENT

PRE-WAR PERIOD

For many years before the United States entered the World War the training of Medical Department personnel was carried out chiefly by the regular courses of instruction given medical officers at the Army Medical School, in Washington, D. C., and at the Army Service Schools, Fort Leavenworth, Kans.; by the courses given the Hospital Corps in field hospitals, ambulance companies, and detachments; and by the teaching of hygiene and first aid to other branches of the Army.¹ This training which, at first, was confined to the Regular Army, was extended, in time, to the National Guard and to Medical Reserve officers in limited numbers. The field service and correspondence schools for medical officers, Army Service Schools, Fort Leavenworth, Kans., established in 1912, had annually graduated classes of medical officers of the Regular Army and Organized Militia, and had conducted extensive correspondence courses. This school developed the nucleus of men who were later to make possible a broader training on the Mexican border and throughout the Army and the Organized Militia.

ON THE MEXICAN BORDER

During 1916-17 a more elaborate scheme of training, to include officers and enlisted men, was carried out on the Mexican border, under a comprehensive plan prepared by the general sanitary inspector and approved by the commanding general, Southern Department.² Under the provisions of this plan, the training of medical officers and enlisted men of the Medical Department was prescribed, standardized, and enforced.

The value of this border scheme of instruction in carrying out the final Medical Department war training can scarcely be overestimated. Through it, a considerable number of instructors, more or less adequately equipped, were listed, and the best type of training necessary to meet needs became apparent. Hence, when the final need for training suddenly developed, the Medical Department was prepared, in a way, to meet it.

WAR PERIOD

On the day that the United States declared war, the following letter, urging the immediate necessity of instituting measures for the training of Medical Department personnel, was submitted to the Surgeon General:³

1. Simultaneously with the organization of the military forces, the special technical training of the sanitary personnel necessary thereto should be begun. There should be no delay or lost motion. It should be continued without cessation or depreciation so long as the military forces remain in being.

2. On the basis of the raising of the initial war forces of 1,000,000 men, this means a complementary force of 7,000 medical officers immediately required; of whom 500 may be regarded as now well trained, 1,000 as partly trained, 5,500 not trained at all. A further reserve of at least 1,000 officers to meet wastage will be required, and are likewise now untrained.

The same force, for the meeting of its war needs, implies about 100,000 enlisted men of the sanitary service, of whom perhaps 5,000 may be regarded as now trained, 5,000 as partly trained, and 90,000 as not trained at all.

The urgent need for the immediate creation of some effective administrative machinery capable of transforming the above mass into an efficient trained sanitary personnel, without unnecessary delay and difficulty, is obvious.

3. Recent experience on the border has demonstrated that sanitary personnel constantly tends to become sedentary and lose interest, and its work to degenerate into a brief daily internal routine of little training value, except under the stimulus of constant pressure from above. Also that forced training, if recognized as helpful and constructive, greatly promotes contentment among medical officers.

It has likewise demonstrated that line commanders appreciate their own lack of special technical information about sanitary work, leave all initiative in such matters to their medical subordinates, but heartily support plans for sanitary training if these are presented to them.

Whatever of training is done will be due to the initiative, force, and ability of the sanitary service itself. It will strain to the limit every resource of the inadequately manned Medical Department to well acquit itself in the tremendous task now before it.

4. The general scheme for training should be planned, organized, directed, and controlled in the Office of the Surgeon General. If left to local authorities, it will be imperfect and largely ineffective. One officer in the Surgeon General's Office should direct this training. It will take practically his entire time and effort.

The training must be coordinated, comprehensive, and progressive, yet at the same time elastic enough to meet the needs of new increments of untrained medical officers and men. It should cover every phase of the duties of a medical officer and sanitary soldiers.

Local commanders and local sanitary training officers should have no power to disregard or modify such a training scheme in any important essential.

5. The details of the training should be general; requirements, to be specified by the Surgeon General, should be supervised and enforced by a sufficient number of specially designated medical officers attached to troops and selected for their abilities in this respect.

In view of the comparatively recent attention given in our Army to sanitary tactics and field work, only a relatively few officers are probably qualified to act as instructors. An insufficiently qualified instructor will invite criticism and dissatisfaction.

It is earnestly recommended that those who are qualified be given this duty, so that the great mass of untrained personnel may be leavened as quickly as possible, even though the interest of lesser fields of activity suffer slightly thereby.

These training officers should prescribe all details necessary to carrying out the general scheme of the Surgeon General under divers local conditions, see that the training is fully and efficiently carried out through frequent inspections and direct participation in the work, and arrange all local matters necessary to lectures, conferences, war games, drills, marches, tactical exercises, field maneuvers, etc.

6. The sanitary personnel to be trained should not only include those actually with the colors, but also those in civil life obligated to render service at call, or whom it is desirable to train up against future need.

At the outset, those with the colors should first be trained so as to secure as large a number as possible of trained men to help with the work of instruction of later increments.

7. The scheme of instruction naturally divides itself as follows:

(1) To sanitary personnel on duty with the colors: The subjects for this class, so far as officers are concerned, divide themselves into (a) sanitary organization and sanitary tactics,

(b) military hygiene and sanitation, (c) clerical functions, (d) general professional methods as modified by the environment of war, (e) military information relative to the government of medical officers and men as part of the Army.

For enlisted men, the training should cover that now laid down in the Manual for the Medical Department, Drill Regulations for Sanitary Troops, and Mason's Handbook.

The theoretical training connected with the above should include prescribed courses of reading, recitations, conferences, demonstrations, and map maneuvers.

But the training should as far as possible be practical, making use of all the usual facilities of hospitals, camps, marches, and maneuvers for the purpose. In addition, periodic sanitary maneuvers on a large scale should be carried out.

The personnel for instructors of this class is mentioned elsewhere.

(2) To officers of the medical section, Officers' Reserve Corps, not yet called to the colors: The same subjects as are mentioned under (1), except in a more elementary way. From the nature of things, this instruction must largely be theoretical and didactic. It is preliminary to the more comprehensive training contemplated when called to service with troops.

No training of potential soldier recruits still in civil life, in advance of their enlistment, seems practicable, unless the Red Cross will charge itself with such work.

Instruction to this class of reserve officers may be given in connection with that for officers in active service in their vicinity, by medical officers on special duty, by conferences among the student officers themselves, and by correspondence.

(3) To students in medical colleges, as prospective medical officers: The subjects for this group include: (a) First-aid and emergency surgery from the military standpoint; (b) schools of the sanitary soldier, litter drill, and transportation of wounded; (c) elements of sanitary organization and sanitary tactics; (d) elements of military hygiene and sanitation.

The instruction here should be given in the present emergency by their present civilian instructors, who should be appointed in the Officers' Reserve Corps and would themselves learn much through the necessity of having to teach others.

(4) General information: This includes dissemination of diverse items of current medico-military value through—

(a) Orders, circulars, bulletins, books, etc.

(b) *The Military Surgeon*.

This is a very valuable aid to supplement the standardized instruction and should be utilized to the utmost.

8. With each field army there should be, under the chief surgeon thereof, a medical officer as training officer, with the rank of colonel. It is his duty to see that the training of all officers and men throughout the field army is suitable, sufficient, and coordinated. His work is one of direction and inspection.

9. With each division there should be, under the division surgeon, a medical officer as training officer, with the rank of lieutenant colonel. He directs, teaches, and inspects.

He should have direct military control, under the division surgeon, of the sanitary personnel of the division. For this purpose, the sanitary personnel of the division should be organized as a regiment of three battalions—one battalion of which may be assumed as on detached duty with the component combatant organizations of the division and under the orders of the commanders thereof. The other battalions in actual being to consist of divisional troops, one battalion to be the ambulance battalion and the third the field hospital battalion.

But whether this proposed organization is accepted or not, a training officer is absolutely necessary for the education of all the sanitary personnel with the division. It will take the entire energies of one officer on this work alone to bring about even reasonably satisfactory results.

Officers who have had suitable experience with ambulance companies and field hospitals should be designated as directors of ambulance companies and field hospitals, thereby greatly facilitating the training of these units. Unfortunately the entire available supply of these trained men will not equal the demand.

Instruction in the clerical work with the division will have to be done by a special officer, not necessarily of higher rank than captain; such an officer should be attached to the division surgeon's office and work directly under the training officer. His work is to remove at their source all the present great difficulties connected with the paper work of untrained officers, and thereby save a vast amount of inaccuracy and resulting correspondence.

10. For independent forces smaller than a division, a training officer with the rank of major is necessary.

11. If troops are not organized into the large tactical organizations, the same plan as above, applied to departments, districts and camps, will serve.

12. The inclosed "Memorandum of instruction for medical officers and sanitary units,"^b prepared by the undersigned and issued in the Southern Department for troops along the Mexican border, should serve, with but little change, for the training of sanitary personnel in the mobilization camps contemplated.

13. The foregoing scheme does not include the training of medical officers and sanitary soldiers at special medical camps or training schools, as has been found desirable in the British service for the personnel not actually required with troops to serve their immediate needs.

Such separate training is most desirable; but its details have not been entered into pending any plan by the General Staff for the training of the officer class as a whole, with which the sanitary training should as far as possible be coordinated.

14. If desired, the undersigned is prepared to work up a complete scheme for training, in detail.

PLAN FOR TRAINING

The above letter and its purpose were approved by the Surgeon General, and its author was directed to prepare the necessary plan and to put it into practical execution after conference with the Bureau of Militia Affairs, which had just prepared a short course of armory training for the Medical Department of the Organized Militia. This was done after conference with the representative of the Medical Department in the Bureau of Militia Affairs, and a joint report was sent in by them on April 16, 1917.³

This joint report was forwarded on April 21, 1917, by the Surgeon General to The Adjutant General, with the following remarks:³

* * * * *

As soon after enrollment as their services can be spared from recruiting or other preliminary duty, all officers of the medical section of the Officers' Reserve Corps will report in turn, as their services can be spared, at such camps as may be designated for a three months' course of instruction, the scope of which will be fixed by the Surgeon General.

2. The attached scheme affords a plan for starting, without delay, the necessary training of the officers and men of the Medical Department. It can be modified later as experience may warrant. It proposes to carry out an intensive training of both officers and enlisted men, both in special training camps and in addition to necessary service with troops. For the former class, the course covers three months; for the latter, six months.

3. The nature and scope of the proposed course, sample daily routine, list of textbooks, etc., are given therein.

4. For the above instruction purposes it is believed that four medical training camps should be established. The Medical Department, among other cogent reasons, can not furnish instructors or equipment for more than this number. They should be established in conjunction with the general officers' training camps at Fort Oglethorpe, Fort Riley, Leon Springs, and Fort Benjamin Harrison, and later, if found desirable, one on the Pacific coast; but if a suitable camp and maneuver ground can be found on the Atlantic seaboard south of New York, this should be substituted for Fort Benjamin Harrison.

5. If approved, I recommend that the necessary facilities for shelter, messing, supply, etc., be provided without delay for the use of these training camps at the above points.

^b This memorandum is on file in the Office of the Surgeon General (Old Files, 7,832).—Ed.

6. Authority is also requested for the bringing to these training camps of a training staff of approximately one officer instructor to each 50 student officers, together with such enlisted personnel as may be necessary.

7. I also request that 1 ambulance company and 1 field hospital be sent to each of these training camps, and that 3 additional ambulance companies and 3 additional field hospitals be organized at each without delay. Also that each training camp be further provided with an enlisted force equivalent to six regimental sanitary detachments. The above personnel is necessary to visualize medical organizations, equipment, and field work, and serve as a service corps in looking after the training camp and the many hundreds of student officers to be in attendance.

8. Authority is further requested for the establishment of a training course for the sanitary personnel with troops, the appointment of officers as training officers, with divisions or separate camps, and the establishment of a system of inspection sufficient to insure the efficiency of the same.

9. It is requested that this matter be given decision as soon as possible. It is understood that the general training camps are to begin operation on May 15. The Medical Department should begin its work at least by that time, and, if possible, one or more of its camps should be put into operation before that time.

10. Attention is invited to the fact that the work of the Medical Department actively begins the moment troops are raised or brought together, and that the equipment of these training camps, the detailed organization of the training course, and the provisions of the staff of instructors should therefore be made as soon as possible.

11. Attention is invited to the attached plan, which is concurred in.

W. C. GORGAS,
Surgeon General, United States Army.

The plan was approved and acted on by the War Department, as follows:

[First indorsement]

2581692

WAR DEPARTMENT, ADJUTANT GENERAL'S OFFICE,
May 11, 1917.

To the SURGEON GENERAL.

With the information that the establishment of additional subdivisions of the work in the Office of the Surgeon General, as referred to herein, is approved with the following exceptions:

That no increase of the Medical Corps in number or grades shall accrue therefrom: That the chief of the sanitary section may consult with, and make recommendation to, the Quartermaster General in regard to construction of a sanitary character, and may also recommend sanitary orders, but all orders will be issued in the way now prescribed by regulations; and

That four medical training camps, to begin June 1, 1917, with an attendance of officers for training at each to be not over 600, are approved; and that the tentative scheme of instruction is approved and will be submitted in form to be published as a general order.^c

In this connection attention is invited to copy of letter sent to commanding generals, Central, Southern, and Southeastern Departments, relative to the establishment of the medical training camps referred to above.

By order of the Secretary of War:

WM. M. CRUIKSHANK, *Adjutant General.*

^c Special Regulations No. 49a, W. D., May 15, 1917.

[First indorsement]

2581692

WAR DEPARTMENT, ADJUTANT GENERAL'S OFFICE,
May 11, 1917.

To the QUARTERMASTER GENERAL:

For his information, and with request to provide cantonments at each of the medical training camps mentioned herein, as follows:

Infantry cantonment for 600 men.

Cantonment for 4 ambulance companies and 4 field hospital companies of the Regular Army.

The cantonments to be ready for occupancy before June 1, 1917.

By order of the Secretary of War:

WM. M. CRUIKSHANK, *Adjutant General.*

(Copy of first indorsement on 2581692 to Surgeon General accompanying.)

MAY 11, 1917.

From: The Adjutant General of the Army.

To: The Commanding General, Central Department, Chicago, Ill.

Subject: Medical training camps, 1917.

1. The Secretary of War directs that you establish medical training camps in connection with officers' training camps already authorized, to begin June 1, 1917, at the following posts in your department:

Fort Riley, Kans.

Fort Benjamin Harrison, Ind.

2. The purpose of these medical training camps will be for the training of reserve medical officers; the attendance at each camp not to exceed 600; the course of instruction to begin June 1, 1917. The Quartermaster Corps will provide an Infantry battalion cantonment for 600 men and cantonment for 4 ambulance companies and 4 field hospital companies of the Regular Army, these cantonments to be ready for occupancy before June 1, 1917.

WILLIAM M. CRUIKSHANK, *Adjutant General.*

The same letter was sent to the commanding general Southern Department, Fort Sam Houston, Tex., substituting Leon Springs for Fort Riley and Fort Benjamin Harrison, and to the commanding general Southeastern Department, Charleston, S. C.

The proposed medical officers' training camp at Leon Springs, Tex., was never established, through inability to provide the necessary staff of instructors therefor.³ However, authority was later received to raise the quota of student medical officers from 600 to 1,000 at each of the other three camps, with the net result of an increase of 600 medical officers in all.

To each of these camps a training staff of selected regular medical officers, each one recognized as an expert in his line, was assigned.³ These staffs varied from 10 to 12 officers.

The camps had to be organized and buildings erected at a time when large numbers of officers and men were arriving, frequently without advance notice and often without equipment.³ It was a period when the facilities of the Quartermaster's Department were strained to the limit by new construction, but some tentage was secured and put up, and buildings subsequently were erected rapidly enough to meet actual needs.

There was much shortage and delay in respect to clothing, equipment, and other supplies, due to inability of the supply department to meet the needs of a rapidly expanding army.³ Fortunately, no hardships resulted, and participation in the actual organization was in itself a valuable phase of training.

The work of instruction was at once started. As the first need for medical personnel was obviously to be with the regiments and divisions shortly to be organized, a course was worked out to meet such need for the zone of operations and this remained as the basic course of the training work throughout the period of the war.³ Later, courses for line of communications work, for special training in various medical branches, and courses for the several nonmedical branches of the Medical Department were organized.³

The plan of instruction, including the basic course of training, to be carried out at these medical training camps was covered in the following letter of instructions:^{4 d}

1. These instructions are intended to coordinate the work at the various medical camps of instruction so that it will be carried out on common lines.

Also so that the instruction given at these camps, and that which it is proposed to give the medical personnel necessarily serving with troops to meet their needs in the field and at posts, shall have similar basis and method.

To the end that the instruction to be given, and the results to be secured, shall be standardized, the general provisions of this letter will be strictly carried out. All details of execution are left to you, and you are held responsible for proper results.

2. The course at the medical officers' training camp is intended to give the student officers a general idea of the basic duties of a medical officer and prepare them for service with troops in the field.

Training will be intensive and pushed as rapidly as possible. It will be borne in mind that the service of thousands of instructed medical officers must be available at an early date.

3. The training to be given is intended to prepare these officers to conduct the service of the Medical Department without either the supervision of experienced medical officers or the aid of well-qualified noncommissioned officers. The limited number of these two classes in the Medical Department, and the necessity of assigning many of them to important administrative duties, render it probable that few will be available for regimental duty, and only a small number with ambulance companies and field hospitals.

For this reason, also, upon the reserve medical officers graduated from these training camps will fall the duty of themselves drilling and training the very many thousands of enlisted raw recruits which will be assigned to the Medical Department, and they must be put into a condition to carry out effectively this most important work.

4. Each camp will have accommodations for 600 medical officers. They will be organized into companies, duly officered and noncommissioned officered from among themselves, and trained on a basis of medical cadets. It is desired to impress upon these new officers, by actual experience, what will later be required by them of their subordinates.

5. Your staff will be composed of an assistant commandant, an adjutant, and a quartermaster, all of whom will be instructors in addition to their other duties. It is proposed, if possible, to assign you additional instructors on the basis of 1 to each 50 student officers. Due to the shortage of regular officers, specially qualified militia medical officers may be assigned to such duty. Officers with regimental detachments, ambulance companies, and field hospitals will, in addition to their duties as such, serve as instructors.

You will make such assignment to instruction duty as you deem best, making due effort to assign to each subject officers known to you to have given special attention thereto and to possess ability to impart information.

You are authorized to use as instructors any student officers found specially qualified in any subject, and to give them special authority while so serving, irrespective of rank.

Your staff of instructors will, if desired, give the necessary instruction in hygiene and first aid to the line officers of the adjacent training camp. Conversely, you should ask the assistance of the line officer instructors at line camps in teaching map reading, in special lectures, and in the tactical part of medico-military problems and maneuvers.

⁴ This basic course was found satisfactory, practically without change, after a year's trial.

6. Instruction by lectures, except in special subjects, will, as far as possible, give place to recitations. Lectures are not considered as effective as recitations in imparting detailed information, nor do they afford opportunity to test the capacity and grade the student.

Lessons will, therefore, be assigned in the authorized textbooks, and quizzes held thereon, for the purpose of grounding them in theory and insuring that a competent knowledge of methods and principles has been acquired.

7. But coincident with this theoretical instruction, the student officers should as far as possible be made to visualize the organizations, apparatus, and methods concerned. In addition to study and lectures, it is most important that they should learn by seeing and doing. So far as possible, instruction will be made practical.

To this end, for example, all sanitary appliances and methods likely to be of use in field work will be procured or constructed and continually kept in effective operation at the camp, and the officers will be shown their purpose and practical use.

Bombproofs for trench warfare and gas chambers for practical trial of protection against poison gases will be constructed.

In connection with paper work, all papers required by the medical and other departments will be actually made out until familiarity therewith, and correctness of result, is secured.

Mess management, taught in theory, will be actually demonstrated in the organization kitchens. Applied camp sanitation will be taught by sanitary inspectors. Drill will be taught until every officer can himself effectively handle and instruct therein the units and detachments of the Medical Department.

The internal economy and administration of regimental detachments, ambulance companies, and field hospitals will be taught not only by books but by assignment to such organizations and quartering and subsistence therewith, and by actually handling them in marches and comprehensive field problems. To permit of the latter it is expected that 4 ambulance companies, 4 field hospitals, and 6 regimental sanitary detachments, all complete and kept recruited up to war strength, will be organized at your camp without delay. The regimental detachments will be organized as two provisional companies, to be split into their integral parts for demonstration purposes.

8. You will assign student officers to duty with regimental detachments, ambulance companies, and field hospitals as junior officers and supernumeraries, to familiarize them with these organizations, the handling of men, etc. Officers so assigned should be quartered and messed with these organizations, but will pursue the regular curriculum of training at the camp. Assignment should be made in rotation, and ordinarily for 10 days with each organization.

9. The training course will be divided into three periods of one month each. The first, while instructing the officer as such, is intended especially to familiarize him with the duties of his enlisted subordinates whom he must shortly train. The second takes up his training in his own special functions as an officer. The third carries on and completes the work of the second period.

New training classes should as far as possible be started at the conclusion of each month's training period. However, to meet immediate needs, officers needing training will be sent to camps at any time and will be organized at once into groups for instruction.

10. The following textbooks are authorized for the course of instruction: Army Regulations; Manual for the Medical Department; Field Service Regulations; Drill Regulations for Sanitary Troops; Manual for Courts-Martial. Such other school textbooks as may be authorized will be announced later.

These books will be invoiced to you without requisition. You will issue one copy of each to each student officer, who will take them with him when he leaves camp for duty elsewhere, for reference and use in training his subordinates.

Maps and war-game sets will be sent out on requisition.

You will procure maps of the maneuver grounds in the vicinity of your camp from the commanding general of your department. One map should be available to each student officer.

11. The daily instruction, except Saturday afternoon and Sunday, should approximate 7½ hours daily.

It is left to the commandant of each medical officers' training camp to prepare schedules for the hours available in each period of instruction among the subjects and time therefor required. This will enable the meeting of the needs of emergency, stormy weather, etc. Copies of the detailed schedules so prepared by you will be furnished this office as soon as practicable.

12. The following general scheme is suggested for the daily schedules for the first month:

A. m.	
6. 00-----	Reveille.
6. 15- 6. 30-----	Setting-up exercises.
6. 35- 7. 25-----	Breakfast; police of quarters.
7. 30- 8. 25-----	Drill (marching).
8. 30- 9. 25-----	Drill (special).
9. 30-10. 25-----	Quiz or lecture.
10. 30-11. 25-----	Quiz or lecture.
11. 30-12. 55-----	Dinner; rest, etc.
P. m.	
1. 00- 1. 55-----	Quiz or lecture.
2. 00- 2. 55-----	Quiz or lecture.
3. 00- 4. 25-----	Equitation.
4. 30- 5. 55-----	Care of animals, supper, rest, etc.
6. 00-----	Retreat.

13. On this general plan, 180 hours of formal instruction will be given monthly. No evening exercises are contemplated. Time will be needed for study. Saturday afternoon should be a rest period. Officers should be encouraged in equitation on Sunday, preferably in form of tactical ride. The schedule for the third month will vary materially from above, due to the practical field sanitary problems contemplated, and the fact that at least one full half day is ordinarily needed for each. This provides for a total course of 580 hours of instruction.

14. The following scheme shows the proposed scope and distribution of training of medical officers during the first period of 1 month of 30 days:

	Hours
Setting up (15 minutes daily for 26 days)-----	6.5
Drills (marching, litter, ambulance, other means of transport)-----	52
Inspections-----	4
Equitation, bridling, saddling, care of animals, etc.-----	33
Tent pitching, shelter tent-----	2
Tent pitching, pyramidal tent-----	2
Personal equipment of the sanitary soldier-----	1
Field and surplus kits-----	1
Care and maintenance of soldier's equipment-----	2
First-aid, using soldier's equipment only-----	2
Examination of recruits, with papers and finger prints-----	8
Nature and employment of regimental medical supplies-----	8
Customs of the service-----	2
Duties of the soldier-----	4
Relation of Medical Department to rest of Army-----	1
General organization of Medical Department for war-----	4
Army Regulations-----	12
General organization of military forces-----	2
Manual for the Medical Department-----	12
Military hygiene and sanitation-----	6
Field Service Regulations-----	6
Paper work, relating to the Medical Department-----	4
Map reading, use of compass, orientation, etc-----	6

The following scheme shows the scope and distribution of training of medical officers during the second period of 1 month of 30 days:

	Hours
Setting up (15 minutes daily for 26 days).....	6.5
Drills, marching.....	26
Inspections.....	4
Equitation, and care of animals.....	33
Tent pitching, hospital tentage.....	4
Elementary road and position sketching.....	4
The regimental detachment, its use and internal administration.....	8
The ambulance company; its equipment, use and internal administration.....	8
The field hospital; its equipment, use and internal administration.....	8
The tactical use of Infantry (lecture by line officer).....	1
The tactical use of Cavalry (lecture by line officer).....	1
The tactical use of Field Artillery (lecture by line officer).....	1
The use of the Engineer and Signal Corps (lecture by line officer).....	1
The service and mechanism of supply in the field (lecture by quartermaster).....	1
Paper work, relating to the Medical Department.....	12
Paper work, relating to the Quartermaster's Department.....	4
Paper work, relating to the Ordnance Department.....	2
The Medical Department in campaign.....	8
The principles of sanitary tactics.....	8
Map problems.....	4
War games.....	8
Military hygiene and sanitation.....	12
Army Regulations.....	6
Manual for the Medical Department.....	6
Lectures on special subjects.....	4

180

The following scheme shows the scope and distribution of training of medical officers during the third period of 1 month of 30 days:

	Hours
Setting up (15 minutes daily for 26 days).....	6.5
Drills (service as drill master in drills of diverse nature).....	26
Inspections.....	4
Equitation.....	15
Handling of rations and mess management.....	2
Manual for Courts-Martial and military law.....	8
The Articles of War.....	1
The Geneva and Hague conventions.....	1
The rules of land warfare.....	1
Military surgery.....	8
Poison gases, protection against, symptoms and treatment (demonstrations); liquid fire.....	2
War psychoses and neuroses; shell shock; malingering.....	3
Trench warfare; "trench foot".....	1
Demonstration of trench system, including bombproofs, dugouts, entanglements, abatis, etc.....	1
Cantonment hospitals, organization and management of.....	2
The sanitary service, line of communications.....	1
Hospital ships, ships for patients, hospital trains, trains for patients.....	2
Base hospitals, their organization and management.....	1
General hospitals, their organization and management.....	1
Contagious disease hospitals; casual camps, convalescent camps, camps for prisoners of war.....	1
Organization, functions, and limitations of the American Red Cross.....	1
The civil sanitary function of the Army Medical Department in occupied territory...	1

	Hours
War games.....	2
Tactical rides.....	6
Sanitary inspections, practical demonstration of methods.....	4
Practice march and bivouac (2 days).....	13
Practical field maneuvers, including brigade and divisional problems, with two night problems, and utilizing regimental detachments, ambulance companies, field hospitals, stations for slightly wounded, etc., in coordination. Problems will include the attack, retreat, planned defense and rencontre.....	60
Lectures on special subjects.....	4

180

NOTE.—For the proper conduct of the large medical maneuvers contemplated during this period the services of a company or battalion of the Signal Corps are desirable. The duties assigned to them, however, are such as pertain to their normal functions and training. When line troops are available the above problems should be carried out with them as part of their training as well as that of the sanitary personnel.

15. Dental surgeons and veterinary surgeons will be required to take the general course for medical officers, with the exception of the subjects which pertain more or less exclusively to the work of medical officers as such, with the substitution therefor of subjects directly relating to the dental or veterinary service. Pending instructions from this office, you will arrange tentatively for this special instruction.

16. To stimulate student officers to their best work a certain number of places in the grades of captain and major, Medical Department, Officers' Reserve Corps, will be left unfilled. Appointment will be made to these vacancies from among the student medical officers, who, on vote of your staff of instructors, are recommended by you as possessing such exceptional knowledge, aptitude, and efficiency as would qualify them for such increased rank.

To this end you will establish and maintain a graded system of marking, by which relative efficiency will be recorded.

17. Also medical officers satisfying the age and other requirements and after passing such examinations as the Surgeon General may require may, on your recommendation, and subject to the vote of your staff of instructors, be commissioned at once as first lieutenants in the Medical Corps of the Army.

18. If any reserve officer is found unfit for the service by reason of physical, mental, moral, or temperamental reasons, you will, on vote of your staff of instructors, recommend him to this office for separation from the service.

19. Attention is invited to the great administrative as well as training problems presented by your camp. The large number of medical officers under training must be sheltered, fed, supplied, and administered, their camp policed, wastes disposed of, mounts cared for, etc.

The personnel of the regimental detachments, ambulance companies, and field hospitals will, in addition to their other duties, be used by you as a service corps to carry out the above duties.

20. You will, without delay secure definite accommodations and facilities for your medical training camp, in respect to any other training camps near by, so that there may be no later interruptions, modifications, or curtailment of the work of the Medical Department camps.

21. You will request by wire the number of noncommissioned officers and clerks which you will require for your headquarters and the number of cooks necessary for the officers' messes.

22. For the purpose of practice in equitation you will make requisition at once for the necessary number of mounts, and saddle equipment therefor, on the basis of one mount for each four student officers.

Mounts pertaining to the ambulance companies, field hospitals, and regimental detachments will likewise be used by the student officers in equitation when not actually needed in the work of these organizations.

23. The sick from your camp will receive infirmary treatment from a camp infirmary to be maintained by you. Hospital treatment will be given at the hospitals provided for the needs of the local coordinated training camps as a whole.

You will arrange to have the use of this hospital for the instruction of medical officers in the administration of such hospitals and the training of enlisted men as nurses and as surgical and dispensary assistants.

24. In conjunction with the training camps for medical officers it is proposed soon to establish training camps for enlisted men of the Medical Department. As soon as possible you will prepare a tentative plan for the training of these men in conjunction with the medical officers' training camp and forward it to this office for consideration.

Courses should be based on a three months' period, having in mind that the needs of the service may require the detachment of some of these men after six weeks' or two months' training.

25. You will also prepare and submit to this office plans for advanced courses of training for enlisted men, to cover not more than one month, to be specially instructed as (a) nurses, (b) surgical assistants, (c) dispensing assistants, (d) dental surgeon's assistants, (e) clerks.

26. You will also prepare and submit a plan for the instruction of selected privates who have finished the basic course proposed in paragraph 14, with a view to their promotion as noncommissioned officers. This course should not exceed six weeks. It is proposed to appoint men who, after satisfactorily finishing the basic course for enlisted men and the additional course for candidates as sergeants, are reported by you as qualified for such promotion.

27. Instruction as cooks, horseshoers, farriers, saddlers, mechanics, and chauffeurs of enlisted men who have finished the basic course of training will, it is contemplated, be given in the general schools in such subjects which are or may be established for the Army as a whole.

The Medical Officers' Training Camps at Camp Greenleaf, Fort Oglethorpe, Ga., Fort Riley, Kans., and Fort Benjamin Harrison, Ind., were opened on June 1, 1917, although an effort was made to have orders for student officers amended so as to have them report on June 15 (see history of individual camps, *infra*). This effort for delay failed through clerical error in the War Department, and considerable numbers of student medical officers arrived at these camps on June 1, and immediately thereafter. This, though regretted at the time, proved to be fortunate, as it gave an extra fortnight of much-needed training to many.

What this training meant may be inferred from the fact that on August 27, 1917, one week before drafted men were to arrive at National Army divisional encampments, there left from each of the three medical training camps five trains of medical officers and enlisted men of the Medical Department.³ Each train went to its separate camp and contained a quota of about 60 medical officers and 310 enlisted men, who were not only suitably organized for the formations with which they were to serve, but in each detachment officers and men were specially selected for fitness in the duties which they were intended to perform.

These 900 medical officers and 4,600 enlisted men went to the 15 divisions that were ready for them, and were able to provide for themselves, attend to sanitary matters, and arrange for the handling of recruits in great numbers in advance of the arrival of the latter.³ By this means the Medical Department met the strain imposed upon it at the start, and, by drawing from the trained reserve in the training camps, was equal to all subsequent emergencies.

At this time a considerable number of physicians from civil life were entering the Army and were being sent direct to service with troops at posts and camps, without having the benefits of training given at a medical officers' training camp. It was realized that, unless attention was drawn to their shortcomings, and a way prescribed for remedying them, outside of the daily routine, little, if anything, would be done in preparation for future, and probably quite dissimilar, duties. Accordingly, a letter of instruction was sent to all department and Regular Army division surgeons, similar to that given above, outlining the instruction at medical training camps.³ It was realized, however, that many of the facilities at the medical training camps would not be available at posts, garrisons, and small camps, and the course of instruction at such places, therefore, was appropriately modified. A full course of reading was everywhere prescribed, with such practical field work as local facilities afforded. Commanders were charged with enforcement of the requirements of the course, the Inspector General's Department being asked to specially check up this matter. On the whole, this garrison training was very helpful, and a vast amount of work was done by untrained medical officers who, in the absence of such guidance, would have recognized neither its need nor the nature and manner of attempting it.

The next step in the plan of instruction was that for the training of medical personnel with the new divisions. On October 3, 1917, a letter of instruction was sent to all division surgeons, prescribing a course of training effective November 1, to be carried out as rapidly as local conditions permitted and to be concluded only when the Medical Department personnel had demonstrated reasonable qualifications therein before a board of medical officers. (See Chap. IV, *infra*.) The total ground to be covered approximated that included in the medical officers' training camp course, and a "training officer" for each division was ordered designated. As each division contained officers and men who had practically completed the course at training camps, others who had only partially completed it, and still others who had not been trained at all, it will be realized that it was no easy task to give each individual the exact training necessary to remedy his deficiencies.

After covering the prescribed course, and thereby securing the fundamental training of the great majority of medical personnel, no further medical training was officially required in divisions, it being believed that it could be left to division surgeons to require the proper training of such new medical officers and enlisted men as might require training after joining.³ It was believed, also, that the prescribed course of training would furnish any necessary number of instructors for any later course of instruction. In general, these assumptions proved correct.

In the late fall of 1917, it became apparent that a certain proportion of medical officers who had gone direct from civil life into hospitals were not being qualified for their duties as rapidly as desired. The division of hospitals of the Surgeon General's Office was requested to take steps to rectify this condition, which it did by the issuance of a letter dated November 1, and a memorandum in detail dated November 15. In each of these a course of study, training, exercises, clinics, etc., was prescribed. This work is given in detail in Chapter V, *infra*.

After the immediate need for medical personnel for service with troops in the zone of operations had been satisfied, it became apparent that a somewhat different scheme of training from that embodied in the basic course for medical officers' training camp would be necessary for personnel intended for service in line of communications formations, including members of Red Cross and other units, elderly or less robust men, and professional experts whose special talents were too valuable to be wasted by service with front-line troops.³ About this time, a cablegram from overseas urged the sending for duty overseas as rapidly as possible "of these urgently needed troops." A two months' course was organized, therefore, for line of communications men, being essentially an abridged basic course, from which much of the front-line training in sanitary tactics, map work, equitation, etc., had been cut out, and certain additions made in matters of professional training, especially in respect to military medicine and surgery.⁴

Applying the foregoing line of communications course, it early became apparent that the number of medical and surgical specialists entering the Army was not equal to the demand, and that special technical training of a certain number of medical officers would be necessary.³ In this professional training, the great training camps afforded the widest kind of selection of the medical officers apparently best qualified to profit by training in a professional specialty. If, on trial, an officer was not found to measure up to expectations, no further time was spent on him but he was returned to the student body, subject to general duty or other assignment. The better grounded and more adaptable men were thus selected, time was saved from instruction, and the tendency of some officers to pose as experts in a subject in which they merely desired to be trained was thus offset. (See Chap. VI, *infra*.)

In addition to the special schools for the training of medical officers in the professional specialties, beginning in the early fall of 1917, special schools were established in the medical centers of the United States in which courses of instruction were given in general war surgery and fractures, including the Carrel-Dakin method of treating war wounds; oral and plastic surgery; neurosurgery; Roentgenology; neuropsychiatry; urology; laboratory methods; cardiovascular lesions.³ Each of these special schools was established largely through the efforts of the medical officers in charge of the division under which the specialty came in the Surgeon General's Office, in cooperation with the medical committee of the Council of National Defense.³ (See Chap. VII, *infra*.)

Prior to our entry into the war the medical journals of the country frequently published the observations and studies of independent observers of American and foreign nationality, of both the medical service of the armies of the nations with whom we were finally allied and those of our enemies.

As training developed, the obvious need for epitomized texts on medicomilitary subjects caused the Surgeon General to have compiled and published a series of manuals, edited by competent officers, which were distributed among the various schools. The subjects covered follow:

Medical War Manual No. 1. Sanitation for Medical Officers.

Medical War Manual No. 2. Notes for Medical Officers.

Medical War Manual No. 3. Military Ophthalmic Surgery.
Medical War Manual No. 4. Military Orthopedic Surgery.
Medical War Manual No. 5. Lessons from the Enemy.
Medical War Manual No. 6. Laboratory Methods, United States Army.
Medical War Manual No. 7. Military Surgery of the Zone of the Advance.
Medical War Manual No. 8. Military Surgery of the Ear, Nose, and Throat
Manual of Surgical Anatomy, United States Army and Navy.
X-ray Manual, United States Army.
Manual of Neuro-Surgery.

Concurrently with the publication of texts in this country the chief surgeon, A. E. F., developed and published Splints and Appliances, A. E. F., and a Manual of Urology, which were used, in conjunction with other texts, in the schools in the United States.

With the encouragement and support of the chief surgeon, A. E. F., the American Red Cross undertook and successfully published a journal of progressive medicine and surgery under the title, *War Medicine*, which was distributed to all medical officers of the forces abroad. This publication fulfilled an important function in conveying information to medical personnel.

These publications were used as guides for medical officers and made possible a text for instruction as well as a book of ready reference for the officer busy with intensive courses of instruction and work in the United States and in Europe.

Considerable help was obtained through lectures and demonstrations given from time to time to medical officers in the service schools and medical officers' training camps by experienced allied officers.⁵

A number of our specialists were ordered overseas early in 1918 to make tours of inspection of the allied and American hospitals, to observe the methods employed by the allied hospitals in organization and in treatment of special medical and surgical conditions, and to discuss with and obtain from allied specialists their views as to the best methods of organization and utilizing the specialties. These officers were returned to the United States and rendered reports to the Surgeon General covering these problems.⁶

Besides the training of medical officers at the medical officers' training camps it later became necessary to respond to the request of the Dental Corps, Veterinary Corps, and Sanitary Corps to train their officers.³ Schools were accordingly established for this purpose, these nonmedical schools including separate schools for dental surgeons, veterinarians, sanitary engineers, psychologists, and nutrition experts. The courses were based on two months' training, and instruction was limited to the fundamental necessities of the individual service.³

Schools for the training of enlisted men in special work were early developed.³ These enlisted men's schools included those for the making of noncommissioned officers, nurses, and ward men, dispensary, laboratory, X-ray, and surgical assistants, clerks, cooks, chauffeurs, and gas-engine mechanics. Classes of medical officers and enlisted men in automobile maintenance were also maintained.

The medical officers' training camps were required to organize, maintain, and supply a large number of practically every formation which the Medical

Department provides.³ Some of these were permanently attached to the camps as training units, others were provisional organizations without official status but used for training purposes until needed for conversion into new official organizations. Still others were organized solely for the purpose of being sent away at an early or later date.

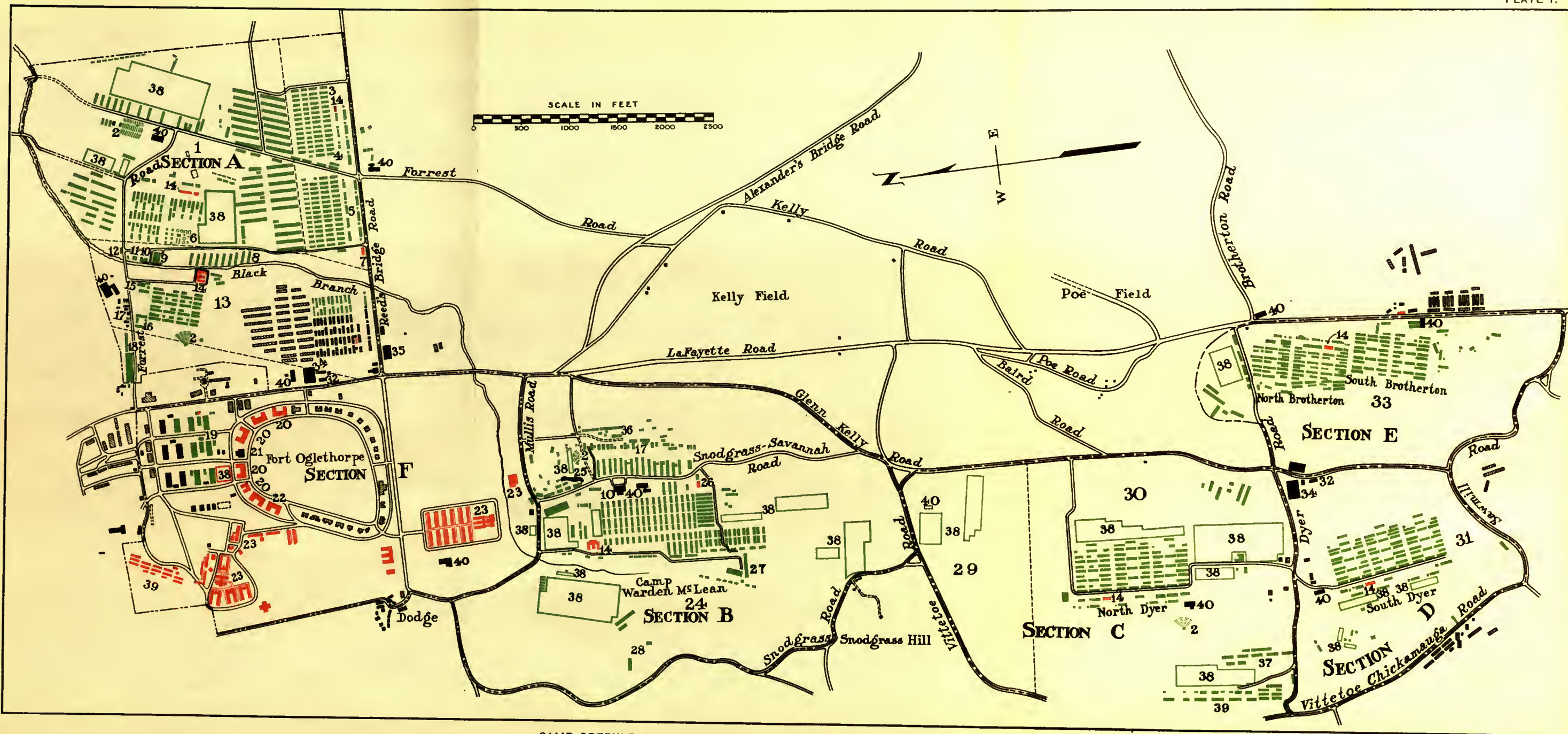
Besides the three training camps already mentioned, a similar camp was established at Fort Des Moines, Iowa, for the training of colored medical officers and colored enlisted men of the Medical Department. Its official capacity was 125 officers and 1,000 enlisted men, and it was in operation between July 21, 1917, and December 1, 1917, when the need for colored medical officers was satisfied. The training given in this camp was in regimental work only, as it was understood that colored sanitary personnel would habitually be attached to colored organizations. (See Chap. II, p. 262.)

The number of medical officers under training was sufficient to fill all drafts made on the medical training camps, but not sufficient to insure that officers so drafted would at all times be adequately trained. The needs of the Medical Department required that 3,000 medical officers, 500 officers of the Dental Corps, Veterinary Corps, and Sanitary Corps, and 35,000 enlisted men of the Medical Department should as a minimum be constantly under training. These numbers, however, were never attained during the war.³

From the foregoing it is seen that Medical Department training in the United States, as finally developed, was conducted in schools and organizations which may be considered under six groups: (1) Medical officers' training camps; (2) divisions camps, and posts; (3) United States Army hospitals; (4) special schools, (5) special professional schools in military and nonmilitary institutions; and (6) miscellaneous schools. These constitute the subject matter of the succeeding chapters.

REFERENCES

- (1) Manual for the Medical Department, 1916, Art. II, 131.
- (2) Memorandum of instructions for medical officers and sanitary units, headquarters, Southern Department, Fort Sam Houston, Tex., August 12, 1916. On file, Record Room, S. G. O., 167,580 (Old Files).
- (3) Report of the Division of Medical Department Training, Surgeon General's Office April 6, 1917, to May 10, 1918, by Col. E. L. Munson, M. C. On file, Record Room, S. G. O., 353 (Training, General).
- (4) Letter from the Surgeon General, U. S. Army, to commandants, Medical Officers' Training Camps, Fort Benjamin Harrison, Ind., Fort Riley, Kans., Leon Springs, Tex., Fort Oglethorpe, Ga., May 16, 1917. Subject: Direction as to nature and scope of instructions to be given at above training camps. On file, Record Room, S. G. O., 353 (Training, General).
- (5) Memorandum from P. M. Ashburn, colonel, M. C., U. S. Army, to J. B. Gowen, colonel, general staff, G-5, general headquarters, A. E. F., March 4, 1919. Subject: Lectures and demonstrations given in service schools and medical officers' training camps by allied officers. On file, Record Room, S. G. O., 201 (P. M. Ashburn).
- (6) Report of a special tour of observation to certain hospitals in an English sector, a French sector, a U. S. Naval Hospital, two American base hospitals in France and a number of hospitals in and near London, by Maj. George E. de Schweinitz, M. R. C., and Maj. Harris P. Mosher, M. R. C. On file, Historical Division, S. G. O.



CAMP GREENLEAF AND CAMP FORREST, CHICKAMAUGA NATIONAL PARK, GEORGIA.

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|---|--|--|---|--|--|---|
| <p>Section A. CAMP GREENLEAF.</p> <p>1. DETENTION GROUP.
Refers to all the northeast part of section A.</p> <p>2. OPEN-AIR THEATER.</p> <p>3. COOKS AND BAKERS' SCHOOL.</p> <p>4. DENTAL BATTALION.</p> <p>5. VETERINARY COMPANY, DENTAL AND VETERINARY STUDENT OFFICERS.</p> | <p>Section B. CAMP WARDEN McLEAN.</p> <p>6. SANITARY LABORATORY.</p> <p>7. DENTAL SCHOOL.</p> <p>8. STABLES.</p> <p>9. McLEAN AUDITORIUM.</p> <p>10. HOSTESS HOUSE.</p> <p>11. LIBRARY.</p> <p>12. POST OFFICE.</p> <p>Buildings occupied by Medical Department shown in GREEN</p> | <p>Section C. NORTH DYER AND RECRUIT CAMP No. 3.</p> <p>13. MEDICAL OFFICERS' TRAINING GROUP.
Refers to all area in section A within dotted lines to the west of 1.</p> <p>14. CAMP INFIRMARY.</p> <p>15. INSTRUCTORS' QUARTERS.</p> <p>16. CAMP HEADQUARTERS.</p> <p>17. CONCESSIONS.</p> | <p>Section D. SOUTH DYER.</p> <p>18. STOREHOUSES.</p> <p>19. SERVICE COMPANY.</p> <p>20. SPECIALISTS' SCHOOLS.</p> <p>21. GUARDHOUSE.</p> <p>22. HEADQUARTERS, GENERAL HOSPITAL No. 14.</p> <p>23. GENERAL HOSPITAL No. 14.</p> <p>24. MOTOR GROUP.</p> <p>Hospitals, dispensaries, and infirmaries shown in RED.</p> | <p>Section E. NORTH AND SOUTH BROTHERTON.</p> <p>25. SWIMMING POOL.</p> <p>26. DENTAL INFIRMARY.</p> <p>27. MOTOR PARK AND SHOPS.</p> <p>28. GAS SCHOOL.</p> <p>29. NONCOMMISSIONED OFFICERS' GROUP.
Refers to all area between north boundary of section C and dotted line.</p> <p>Buildings not under Camp Greenleaf shown CROSSHATCHED.</p> | <p>Section F. FORT OGLETHORPE.</p> <p>30. REPLACEMENT GROUP.
Refers to all area between dotted line and south boundary of section C.</p> <p>31. EVACUATION GROUP.</p> <p>32. KNIGHTS OF COLUMBUS.</p> <p>33. HOSPITAL GROUP.</p> <p>34. THEATER.</p> | <p>35. "Y" AUDITORIUM.</p> <p>36. OFFICERS' QUARTERS.</p> <p>37. DEVELOPMENT BATTALION.</p> <p>38. TENT AREA.</p> <p>39. RECRUIT CAMP.</p> <p>40. Y. M. C. A.</p> |
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CHAPTER II

MEDICAL OFFICERS' TRAINING CAMPS

CAMP GREENLEAF, GA.

CAMP SITE AND BUILDINGS

In May, 1917, it was ordered that a training camp for medical officers, to be known as Camp Greenleaf, be established at Fort Oglethorpe, Chickamauga Park, Ga., to be ready for occupancy on June 1.¹ The commanding officer reported for duty two weeks later.² Certain buildings had been authorized for the camp,¹ but up to the time of the arrival of the commanding officer no steps had been taken to even locate the future site of the camp.³ It was found that the only unoccupied ground to which water could be piped within a period of three or four weeks was a low spot east of the post of Fort Oglethorpe, in the center of which two ridges offered a fairly high and dry location upon which could be placed a few buildings.³ These hills were surrounded by what was practically swamp land, incompletely drained by a ditch. After heavy rains these swamps were sometimes covered with from 2 to 5 feet of water. It was discovered that this ditch could be widened sufficiently to provide adequate drainage for reclaiming all this land and making it suitable for building sites. To have accomplished this by hired labor would have involved a prohibitive expenditure of money.

In the light of all these facts a telegram was sent to the War Department requesting that students be not ordered to the camp until June 15.³ It was too late, however, and the student officers began to arrive June 1. The process of making this swamp land available for occupation furnished valuable experience in sanitation, and the project was completed as part of the instruction in sanitation and hygiene.³

The lumber for construction work was on the ground, but three days before the date set for the arrival of the first student officers (60 in number) no buildings were completed.³ No tentage was available, but a large force of carpenters of the Quartermaster Department so expedited the building operations that by the night of June 1 a floor with a roof but no side walls was provided.³ Eventually the entire area of low ground was covered with buildings and became fairly well adapted to the purposes of a camp site.³

Very shortly after June 1 a supposedly sufficient number of barracks with mess halls and lavatories were constructed to house 1,000 officers but their actual capacity was 650.³ Barracks for 150 men were erected for regimental detachments and others with a capacity of 800 men were provided for the prospective ambulance companies and field hospital companies.³ Later a comparatively level spot along the completed ditch was used as a parade ground for the training group, and special buildings, such as McLean Auditorium, the hostess house, and the camp library, were built along the ditch opposite the parade ground.⁴

ORGANIZATION

GROUP SYSTEM

The student officers were divided into companies and, wherever possible, company officers selected from among those who had received some previous training were assigned in excess of the normal requirements. The object of this was to have a cadet officer for every four cadets, so that these officers could conduct small quizzes within their companies.³

The formal course of instruction for student officers was inaugurated June 15. At that time there were present for duty 75 Medical Reserve Corps officers and 25 medical officers of the National Guard. Six officers of the Regular Medical Corps and one of the National Guard were available as instructors. At first instruction was given by Regular officers, but within a short time the most promising of the student officers were utilized as instructors.³ In the beginning they were employed largely as company officers, drill instructors, and quiz masters, but later they did excellent work as junior instructors.²

On arrival of enlisted men, who in the main were raw recruits, facilities for administrative work had to be provided for the proper and rapid training of these men.⁵ As this training, of course, was distinct from that of the officer, and as they were at that time not organized, a separate system had to be devised. This was called the group system, in which the camp was divided into groups; at first only two, the medical officers' group and the enlisted men's group.⁵ Each of these groups had more or less administrative independence and handled their affairs in a manner similar to a regiment in any of the cantonments for line officers.⁵

As the camp increased in size and as organizations were formed from these enlisted men and officered from the training companies, the number of groups increased and gradually the details of their administration were entrusted to them, with the camp headquarters exercising only general supervision. The camp increased very gradually up to the 1st of June, 1918, and, with this system, notwithstanding the defects which developed in the course of time, the situation could be satisfactorily handled.⁵

The group system was adopted because of its elasticity and because it allowed organizations requiring different forms of training to be separated.⁶ It permitted the training of an unlimited number of men in the various phases of the medico-military activities under one general control. As many groups as were warranted by the number of men to be trained could be formed; and when one became so large as to be unwieldy, it was broken up into two or more groups. Likewise, when a certain class of training was no longer desirable, the group could be enlarged readily to take up other training. This system of administration also relieved the general headquarters of nearly all specialized and routine administration and allowed the general policies of the camp to receive undivided attention.⁶

Within the groups the battalion, as the administration unit, was found preferable to the company, and nearly all organization work was done at the several battalion headquarters.⁶

In March, 1918, the group system having become unwieldy, to a certain extent, the groups containing motor field units, mule-drawn units, evacuation hospitals, and base hospitals were combined into what was called the division of hospitals and sanitary trains, with the division commander exercising tactical control, but with all administrative control still vested in the group itself, or the camp headquarters.⁶ In July, 1918, it was found that the group system, as then in vogue and as had been developed since the beginning of the camp, had grown to such an extent that the individual groups were almost entirely free of the vested authority of the camp commander, and a great deal of friction occurred between different sections of the camp for that reason. This being thoroughly understood, steps were taken by the headquarters of the division of hospitals and sanitary trains to coordinate the camp activities in that section and to weld these different groups together in such a way that, while interdependent, they would still have their proper amount of local autonomy, and the division commander was required to exercise very complete control of these separate units.⁵

In September, 1918, when the camp had attained its greatest size and potentiality for efficient work, the division headquarters was done away with, and each group was then distinctly dependent upon camp headquarters without any intervening authority.⁵ Camp headquarters was then to a certain extent reorganized, with a chief of staff, exercising the duties of his office; a camp adjutant, as had been constituted from the beginning; a camp personnel adjutant, with a distinct development of personnel activities and a concentration of these activities in the one office; the camp inspector, who, though not an officer from the Inspector General's Department, still acted in that manner for camp headquarters in the inspection of all matters arising; a camp surgeon, who had been in the original camp administration, but who had no control over sanitary trains, and other units, being concerned only with the health of the command and having direct supervision over the infirmaries in the several groups; a camp judge advocate, who was also the insurance officer, and who, though this camp had no court-martial jurisdiction, investigated all court-martial cases before they were sent forward; a camp supply officer, a discussion of whose duties will be taken up later.⁵

Effort was made in the final development of the groups to concentrate certain units in the groups which were best qualified to handle their training. For example, all motor units were concentrated in the motor group, where the school for drivers and mechanics was located.⁵ Though each group had its own administrative entity and was related to the camp headquarters in the same way as the individual regiments in the line cantonments, still great care was exercised in the final development of the camp to see that their independence was not such as to jeopardize the proper handling of the general policy of the camp.⁵ By careful instruction and supervision by the commanding officer and the staff of the camp, the relations among the several groups were made so strong that administrative control was simplified and made very effective.

At the time of the armistice these groups consisted of the following:⁵ (1) Medical officers' training group, containing all of the officers' training companies and the special schools for professional instruction for medical

officers; the dental school, for officers and enlisted men; the veterinary school, for officers and enlisted men. All officers reporting for instruction were assigned to the medical officers' training group, which was finally composed of nine battalions of four companies each, but this group could expand to any number of battalions if occasion demanded. (2) The sanitary units group (field hospitals and ambulance companies) for administrative purposes, which was divided at first into two battalions of four field hospitals and four ambulance companies. (3) The detention group, to which all drafted men were sent on arrival for their regular detention of two weeks. This was the same as the detention camp in the regular line cantonments, and was first designated the recruit camp. (4) The motor group, containing all of the motor units and the motor school (on account of a certain amount of crowding, some replacement units were formed in this group). (5) The noncommissioned officers' group, for the training of non-commissioned officers. (6) The replacement group, which, in general, acted in the same manner as the depot brigade of the regular line cantonments. Replacement units for overseas service were formed in this group. The development battalion was also under the commanding officer of this group. (7) The evacuation group, in which all evacuation hospitals and trains were consolidated. (8) The hospital group, in which were formed the base hospitals and convalescent camps.

In addition to the foregoing groups, the service company attached to headquarters carried in its personnel all the general clerical force, cooks, and janitors for the training companies, and men detailed for special instruction, as laboratory and X-ray technicians; the cooks' and bakers' school, where cooks and bakers were trained for the different organizations; the guard company, which guarded the camp and handled all prisoners confined therein; and the military police, exercising strictly military police functions.⁵

Recruits were first assigned to the detention group and remained there during their period of isolation and until their records were completed by the personnel office.⁶ On leaving the detention group, they were sent to the replacement group, and from there they were assigned to the other groups according to their occupational and physical qualifications.⁶ The most promising material was selected for possible noncommissioned officers and was assigned to the noncommissioned officers' group. Motor drivers, motor mechanics, and men of kindred trades were transferred to the motor group. Men who had received previous training as cooks, or those who desired this instruction, were assigned to the school for cooks and bakers. Those experienced in pharmacy, nursing, or similar occupations were sent to the hospital group. The remainder were divided, according to their physical qualifications, into general service or domestic service men, and held for training. Many men without special qualifications were necessarily assigned to organizations, but the system followed assured that all men who had any special qualifications would be assigned where these qualifications would be of the most benefit to the service. This system was frequently interfered with by a lack of sufficient time between the date on which men were received and that on which it was necessary to send them out in order to fill requisitions; also by organizations being ordered formed and sent out without sufficient time elapsing to properly train the

personnel; and frequently by calls for unqualified men in such numbers that those trained or partially trained for special service had to be called upon to fill them; but as near an approach to the system as outlined, as circumstances permitted, was made.

ADMINISTRATION

As finally constituted the administrative control of the camp was excellent, the machinery ran very smoothly, and an immense amount of business was transacted with a camp administrative force much smaller than was usually allotted to the regular divisional cantonments of about equal size.⁵ There were several administrative defects, the source of which was not within the jurisdiction of the commandant, and which were not easily eliminated.⁵ All court-martial cases had to be sent to headquarters, Southeastern Department, and the delay in trial amounted at times to as long a period as six weeks to two months. This caused the guardhouse to be constantly crowded with prisoners awaiting trial or awaiting sentence, which added a great deal to the administrative difficulties and to the duties of the guard company. It also caused constant complaint from friends and relatives of prisoners on account of the delay in disposition of these cases.⁵

Efforts were made constantly to assign the drafted personnel to units according to the approved trade classifications issued by the civilian committee on personnel.⁵ This distribution of personnel could not be followed as completely as desired, for the demands on the camp for replacement and other units for overseas service were so great that very few men were able to remain in camp long enough to be properly classified and disposed of. After the 1st of October, 1918, this classification was more thoroughly carried out, as the influenza epidemic cut short the rapid shipments overseas. In camps of this size organized for technical troops it was not considered that a central personnel office would make the proper assignments according to trade classifications, but a branch office established in the replacement group acted much more efficiently in the assignment of men, particularly as it was found that reclassification had to be made constantly.⁵

One difficulty in administrative control, which was more annoying than of great moment, arose in consequence of the continuance of the post of Fort Oglethorpe, surrounded by Camp Greenleaf. At this post, in cantonment barracks, there were some 3 to 5 troops of Cavalry, and the command of the post was vested in the commanding officer, Fort Oglethorpe, while the post headquarters and a few officers' quarters, as the remainder of the post proper, had been turned over to General Hospital No. 14.⁵

The administrative defect of greatest importance was the complete separation of the supply department from the control of the camp commander. No camp supply officer was provided by orders from the War Department, and the camp supply service was under the control of the subdepot of the Quartermaster Corps, located at Lytle, Ga., 4 miles distant. A great deal of friction was caused by a lack of cooperation on the part of the supply department with the camp headquarters, and frequently supplies requisitioned by the units of the camp were disposed of in a way which was not to the best

interest of the service.⁵ A great deal of delay was caused in proper shipment of troops overseas by the fact that clothing and other equipment was handled too slowly and sufficient supplies were not kept on hand to properly equip troops when called for. Every effort was made by camp headquarters to overcome this defect, but without success, and when cases of lack of cooperation were reported to the War Department weeks elapsed before these could be corrected.⁵ A change in the officer in command of the subdepot, in September, 1918, assisted materially in the better handling of this work, as the officer put in command was more willing to do what was right and proper in the equipment of the units shipped out; but his lack of experience in the service still caused considerable friction.

There was no utilities department at Camp Greenleaf until October of 1918, and that department never really became properly organized, so the camp supply officer, who was an officer of the Quartermaster Corps detailed at the station, by camp orders, handled the utilities work in the main very successfully.⁵

Though the proper functioning of the camp as a whole suffered constant setbacks, owing to the inevitable lack of knowledge of its size and construction on the part of higher authority, there was nevertheless attained a smoothness and efficiency of local administration. With the exception of group commanders, most of the officers were either reserve officers or young Regulars of a few months' service.⁵

On July 1 Field Hospital Companies and Ambulance Companies Nos. 21, 22, 23, and 24 were organized, but these numbers were changed later to 20, 22, 23, 25. The commissioned personnel of these companies came from the student body.³ The enlisted personnel were drawn from the recruit camp.³ A personnel sufficient to form nuclei for the sanitary trains and regimental detachments of the 78th Division, Camp Dix; 79th Division, Camp Meade; 88th Division, Camp Lee; 87th Division, Camp Gordon; and the 81st Division, Camp Jackson, were sent out August 25 and 26, 1917.³

The enlisted personnel for these units was taken from the companies which were organized in July, and when they departed provisional companies were immediately organized from recruits.³ Assistance was rendered during the organization period by officers of the National Guard stationed in this camp.³

September 7 and 8 an ambulance company and field hospital company were sent to the 77th Division at Camp Upton.³ Ambulance Company No. 23 and Field Hospital Company No. 23 were sent to the port of embarkation, Hoboken, N. J., the last of October, for service overseas.³ During October a camp was maintained at Catoosa Springs, Ga., a few miles away, where the ambulance companies went into camp for varying periods.³ On November 1 the field hospitals, ambulance companies, and the base hospital group were combined to form the sanitary units battalion.³ In November, 1917, after the closure of the Medical Officers' Training Camp at Fort Benjamin Harrison, a number of the officers who were instructors at that camp came to Camp Greenleaf for duty.⁶ About this time six Cavalry stables in the post of Fort Oglethorpe were converted into barracks for 100 men each; storehouses, ambulance

sheds, and sheds for animals were also built.³ An officers' building to furnish quarters for instructors was constructed, and later a building for a mess, with servants' quarters attached.³ All other personnel for some time were quartered in tents. No central heating plant was constructed, but all barracks and other buildings were heated by small stoves.⁷

Throughout the life of the camp the housing problem was a serious one. All available shelter, such as stables and sheds, was used, but at no time were there sufficient accommodations for the number of men sent to this camp.⁶

Part of the reserve officers' training camp, Camp Warden McLean, Ga., with a capacity of 1,500, was turned over to Camp Greenleaf November 27, 1917, and was occupied by motor field units.⁶

Up to January, 1918, the camp remained comparatively small, having contained a maximum of 1,087 officers and 3,757 enlisted men at any one time.⁶

During the period between the opening of the camp and January 1, 1918, 11,916 officers and men had been received and 7,072 sent out. Ten ambulance companies, ten field hospital companies, one evacuation hospital, and forty-five regimental detachments were ordered from the camp during this period.⁶

The winter of 1917-18 was the most severe on record in this latitude. The thermometer was frequently down to zero and there were many heavy rain and snow storms. Housing conditions were quite inadequate, and what accommodations existed were very poorly adapted to weather of such severity. Clothing for the enlisted men was very scarce, and woolen clothing and rain-coats were unobtainable. Even wood for fuel was difficult to obtain. The result was that the troops suffered considerably; but with all these discomforts, the health of the camp was extremely good.⁶

Means of communication with the city of Chattanooga were very inadequate in the early days, especially after the advent of severe weather. The road was almost impassable at times, and during a part of the winter the electric line leading to the city was entirely paralyzed on account of a street-car strike, combined with a rise in the Tennessee River. As Chattanooga, 8 miles distant, was the nearest railroad station, except a small branch line at Lytle, Ga., 5 miles from the camp, the situation was quite uncomfortable. These conditions naturally interfered with the administration of the camp to a great extent. Communication was later greatly improved by the construction of a concrete road from Chickamauga Park to Chattanooga.⁶

In February, 1918, the cantonments formerly occupied by the 80th and 81st Field Artillery Regiments were turned over to Camp Greenleaf. These cantonments had a capacity of 1,760 men each.⁸ Up to this time the number of student officers present filled not more than five battalions, but the strength of the department steadily increased, and in this month two more battalions were organized. The 7th Battalion was filled with Veterinary and Sanitary Corps officers. Later the dental officers were placed in this unit.⁸ In February, 1918, the McLean Auditorium was completed. This provided a much-needed lecture hall, as all instruction had previously been given either in the open or in small rooms. The funds needed for the erection of this building were derived from private sources.⁹ The early part of 1918 marked a continuation of the growth

of the camp, which more than doubled during the first three months, the commissioned and enlisted personnel amounting to 10,469 on March 31.⁶ The training of medical officers received a definite stimulus when General Hospital No. 14 was put under the command of the camp commander March 15, 1918. The hospital had formerly been the post hospital, but by War Department orders was designated General Hospital No. 14, and the commandant, Camp Greenleaf, was designated as commanding officer.^{10 6} It was also enlarged to a considerable extent, and thereby played an invaluable part in the training of medical officers in the special schools, and enabled the instructors to combine practical clinical work with theoretical instruction. After that time General Hospital No. 14 was the center of instruction in most of these courses, and by maintaining an excess staff composed of student officers, much valuable training along practical lines was possible. Clinical material was always abundant, as all cases requiring hospital treatment arising in Camp Greenleaf or the other adjacent camps were treated there.⁶

In March the first draft of 7,747 men was received. Prior to this time increments to the camp had been in small numbers and had come either from recruit depots or by transfer from other camps. The arrival of these men from civil life necessitated that the physical examination and other work connected with the draft be carefully organized.⁶

For some time there had been great difficulty in obtaining a sufficient number of officers for the various field details, principally on account of the fact that the specialists divisions of the Surgeon General's Office would not permit officers reserved for these specialties to be detailed to other work, regardless of their qualifications.¹¹ This condition necessitated considerable correspondence between the commandant of the camp and the heads of divisions in the Surgeon General's Office.¹¹ A satisfactory arrangement was finally made, and the following instructions were issued by the commandant to the commanding officer, student officers' group, on April 17, 1918:¹²

1. No officer will be noted as held as a specialist without such instruction from the Office of the Surgeon General. When information is received from one of the divisions in the Office of the Surgeon General that an officer is to be held for some specialty, he will be immediately examined as to his qualifications in that specialty, and the recommendation made to these headquarters. This will be forwarded to the Surgeon General for decision, pending which the officer will be held for the specialty as first indicated.

During May, 1918, the cantonments previously occupied by the 6th and 11th Infantry and the remainder of the Reserve Officers' Training Camp, Camp Warden McLean, were occupied.⁶

During the remainder of the life of the camp it absorbed all the cantonments formerly occupied by the line troops, except what was known as the Viniard and Wilder section, and all of the cantonments previously occupied by the 11th Cavalry, excepting space necessary for the housing of one squadron. This latter cantonment was turned over to the camp in September. The recruit cantonments immediately north of General Hospital No. 14 were also turned over to the hospital in September, 1918, and were used by it thereafter as barracks for the permanent enlisted personnel on duty at the hospital, thereby giving more bed space for sick in the hospital proper.⁶

Up to the latter part of May, 1918, the flow of medical officers through the camp was comparatively regular, an average of 585 per month reporting and 513 departing.⁶

The movement of enlisted men and completed organizations showed little increased activity during this period (April and May), only 8,629 men being received in addition to the March draft. During this time 4 base hospitals, 3 evacuation hospitals, 1 field hospital, 8 hospital trains, 1 ambulance company, 1 evacuation ambulance company, 3 convalescent camps, and 6 sanitary squads departed, and each month a replacement draft of approximately 200 men was called for. The increasing size of the camp requiring a proportionate increase in the permanent cadre, together with the number who were in training as specialists in hospitals and other organizations, made it extremely difficult to supply the men required for replacement units and untabulated detachments.⁶ Many trained units which had been organized had to be stripped to supply the men. This was a decided disadvantage and necessarily told against the efficiency of the completed organizations.⁶

With all the demands for officers and enlisted men to fill these requisitions, there was, in June, 1918, no definite pronouncement in regard to the expansion of the camp.¹³

The increasing need for additional personnel in the permanent cadre of the camp is shown very clearly by a description of the constitution and duties of the service company which was organized May 6, 1918.¹⁴ The service company, which was the largest single organization of enlisted men in Camp Greenleaf, was formed by a merger of Headquarters Company No. 1, Sanitary Company No. 1, and the infirmary detachment, with a personnel of 4 officers and 569 enlisted men. It was expanded by 127 men and was augmented by transfers to and from the command until it had 3 officers and 696 enlisted men.¹⁴ The chief reason for the gain was due to the rapidly developing activities of Camp Greenleaf and the constantly increasing demand for service. The company supplied men to operate the camp headquarters, the camp infirmary, personnel office, quartermaster office, quartermaster storeroom, quartermaster shops, 6 post exchanges, 16 mess halls, the commissary, Camp Greenleaf post office—also the military post office at Lytle—25 men for military police duty in Chattanooga, Tenn., and the post, and also had the entire sanitary work for the training group.

During the month of July, 1918, the long contemplated merger of the Medical Officers' Training Camp at Fort Riley with Camp Greenleaf was consummated by the transfer to Camp Greenleaf of 65 medical officers and 322 enlisted men, including the excellent Fort Riley band.⁶ The greater number of these officers were detailed as instructors. The remainder were assigned to administrative duties.⁶ During the latter part of August and the 1st of September large numbers of enlisted men were received from the post, and when the need for space became very acute a special investigation of the situation was made by the General Staff, and it was proposed to acquire a tract of land to the south of Chickamauga Park and thereon erect a cantonment with a capacity of 10,000 men.¹⁴ This was approved throughout until considered by the War Labor Board, which disapproved the project on account of the difficulty in obtaining sufficient labor to construct the cantonment.¹⁵

The influenza epidemic made its first appearance at Camp Greenleaf September 25, 1918, 26 cases being reported that day.⁶ During the month of October the epidemic reached its height and disappeared completely by the 26th of the month. During this time there were 2,353 cases of influenza and 1,200 cases of pneumonia admitted to the hospital. Most of the latter entered as influenza cases. The deaths numbered 325. Approximately 25 per cent of the pneumonia cases terminated fatally. The epidemic greatly interfered with the activities of the camp; few men were received during the period and few organizations departed.

During the period June 1, 1917, to November 30, 1918, 6,640 officers and 31,138 enlisted men were received and 4,318 officers and 22,161 enlisted men departed during the same period.⁶ The average monthly strength was 2,619 officers and 17,441 enlisted men. During this period the following organizations were completed, equipped, and most of them departed from camp: 63 base hospitals, 37 evacuation hospitals, 5 field hospitals, 13 hospital trains, 5 ambulance companies, 21 evacuation ambulance companies, 9 convalescent camps, 10 replacement units.⁶ In addition to these, numerous detachments were also sent out.

The latter half of the year 1918 was an era of progressive growth in extent, activities, and usefulness of the camp. This abundantly filled the hopes and exceeded the expectations of those who had shared in its development. During the latter half of this period the influenza epidemic seriously curtailed activities, but except for the temporary check the business of training officers and enlisted men, forming organizations, and filling War Department requisitions for troops was carried on with a maximum of efficiency and achievement.⁶ Many factors contributed to this result. The intelligent and willing cooperation of officers and men was probably the chief contributing feature. The administrative system developed and perfected through 12 months of experiment had finally become clearly defined and was being carried out with considerable success. During this period the system proved itself capable of absorbing thousands of men within very short periods of time and assimilating them without effort; also of dispatching equal numbers of trained soldiers and organizations without in any way disrupting the training and other activities of the camp.⁶

TERMINATION

The middle of November, 1918, practically terminated the activities of Camp Greenleaf, as far as its original purpose was concerned, although a few more officers and enlisted men were received and some ordered out, and the training program was continued throughout the month.⁶ The end was approaching, however, and demobilization was the growing consideration. During the latter part of November and all of December demobilization was carried out as rapidly as facilities would permit, and it was completed early in January, 1919. Camp Greenleaf had been designated in War Department orders as a general demobilization camp,^{6 16} and on December 18, 1918, command for this purpose was assumed, which event may be taken as the definite termination of the activities of the camp as a medical training camp.⁶

HEALTH

The health of Camp Greenleaf was universally good, despite rather trying conditions, caused by poor housing and overcrowding, as may be judged from the following tabulation:¹⁷

[Enlisted men only, 1918]

	Number	Rate
Admissions.....	8, 271	699.15
Deaths.....	134	11.33
Discharges.....	273	23.07
Noneffective.....	68, 732	15.92

TRAINING GROUPS

MEDICAL OFFICERS' TRAINING GROUP

All officers reporting for the course of instruction were assigned to the medical officers' training group, which was composed of 9 battalions of 4 companies each, but which, when occasion demanded, could be increased to any number.⁶

The group was an administrative entity and had disciplinary control of all student officers. Though professional examinations of all student officers had been held for some time in this group, this examination was made official by the Surgeon General in April, 1918, and a regular report was rendered monthly.¹¹ The following is an example of such a report and shows the general professional distribution of the officers reporting for instruction:¹⁸

The following is the report of the classification of incoming student officers for the month of October, 1918, with their respective grades.

	Number	Per cent		Accepted	Refused
MAJORS			CAPTAINS—continued		
Total examined.....	6		Specialties:		
Medicine:			Orthopedies.....	13	0
Qualified good.....	4	66	Anesthesia.....	1	0
Qualified.....	2	33	Opthalmology.....	2	2
Surgery:			Otolaryngology.....	1	8
B.....	2	33	X ray.....	11	0
C.....	2	33	Sanitation.....	13	2
D.....	1	16	Plastic and oral.....	17	0
Junior.....	1	16	Urology.....	13	1
Accepted for specialists:			Laboratory.....	1	1
Neurology.....	1	16	Neurology.....	0	0
Administration.....	1	16	Epidemiology.....	1	0
Epidemiology.....	1	16	Total.....	73	14
CAPTAINS			Accepted, 25.2 per cent.		
Total examined.....	289		Refused for incompetency, 16 per cent.		
Medicine:			LIEUTENANTS		
Qualified plus.....	3	1.04	Total examined.....	560	
Qualified good.....	25	8.85	Medicine:		
Qualified.....	191	66.09	Qualified plus.....	6	0.01
Qualified junior.....	50	17.30	Qualified good.....	28	.05
Qualified minus.....	20	6.92	Qualified.....	372	66.42
Surgery:			Qualified junior.....	110	19.64
A.....	1	.35	Qualified minus.....	44	7.85
B.....	23	7.96	Not qualified.....	1	.001
C.....	55	19.03	Surgery:		
D.....	51	17.65	A.....	1	.001
Q. Assistant.....	34	11.76	B.....	15	2.69
Q. Minus.....	18	6.23	C.....	77	13.75
Q. Junior.....	87	30.10	D.....	85	15.17
B. Abdominal.....	4	1.38	Q. Assistant.....	103	18.39
C. Abdominal.....	14	4.84	Q. Junior.....	205	36.60
C. Orthopedie.....	1	.35	Q. Minus.....	66	11.78
D. Orthopedie.....	1	.35	Not qualified.....	1	.001
			C. Abdominal.....	7	1.25

	Accepted	Refused		Number	Per cent
LIEUTENANTS—continued					
Specialties:			Total of officers examined.....	855	
Orthopedies.....	20	1	Total held for special sections.....	485	
Anesthesia.....	4	1	Percentage held for sections.....		56.73
Ophthalmology.....	10	3	Percentage allowed for sections.....		50.00
Otolaryngology.....	11	14	Qualified for special divisions:		
X ray.....	20	0	Orthopedies.....	33	3.86
Sanitation.....	18	7	Anesthesia.....	5	.58
Plastic and oral.....	18	0	Ophthalmology.....	12	1.40
Urology.....	35	5	Otolaryngology.....	12	1.40
Laboratory.....	8	3	X ray.....	31	3.63
Neurology.....	3	1	Sanitation.....	31	3.63
Epidemiology.....	3	0	Plastic and oral.....	35	4.10
Total.....	150	35	Urology.....	48	5.61
Accepted, 36.8 per cent.			Laboratory.....	9	1.05
Refused for incompetency 23.3 per cent.			Neurology.....	4	.47
			Epidemiology.....	5	.58
			Administration.....	1	.12
			Surgery.....	196	22.93
			Medicine.....	63	7.73
			Total.....	485	56.73

Total number examined in September, 897.

Special divisions in September, 375.

Percentage for special divisions in September, 41.8.

October percentage 6.73 over.

September percentage 8.2 under.

SANITARY UNITS GROUP

On November 1, 1917, the field hospitals, ambulance companies, and base hospital group were combined to form the sanitary units group.¹⁹ For administrative purposes this was considered as 2 battalions of 4 companies each. The 4 ambulance company units and the 4 field hospitals had each a provisional director. Each company had its full complement of student officers and under the direction of the provisional director, performed every function required of a company in the field. Mess accounts, clothing requisitions, sick reports, etc., were made in each company under the guidance of the director. The group commander, in turn, served as a mentor of the directors and prepared, by correction or by consolidation of requisitions, reports, and returns, all papers that left the group for forwarding to the camp commander.¹⁹

Instruction, other than practical work within companies, was conducted under the regulation of the group commander, whose relation to the various organizations was identical with that assumed by the commandant to the various groups of the camp. The unit group, therefore, was largely independent. Indeed, effort was made to increase in every way the responsibility of the group commander, who was judged by this output rather than by the methods he employed.¹⁹

While the group commander had full charge of the instruction of his officers, the commandant required him to see that all of his officers kept up with the central basic course. Usually one or more officers of the group attended these lectures, and they instructed the other officers of the group by night quizzes. The special courses given by the group commander and his staff therefore, were, extra and additional to the main basic course taken by all student officers. The programs adopted for these courses were examined and approved by the commandant before they were put into effect. Thus the commandant was able to to unify and coordinate special and basic courses.¹⁹

The student officers in this group were under the direct control of the group commander and the assignments made to the group were considered as permanent. The numbers assigned were always in excess of requirements, so

that when a company left, its place could be filled immediately by a fairly well trained personnel of officers and noncommissioned officers.¹⁹

This group remained intact only one month, when it was divided into two groups, one containing the motorized companies and the other the animal-drawn companies.³

HOSPITAL GROUP

The first base and evacuation hospitals at Camp Greenleaf were formed in Battalion No. 14, located in the medical officers' training camp. Later, Battalion No. 14 was moved to the southern end of Chickamauga Park, occupying barracks and quarters vacated by line troops, and became known as the hospital group of the division of hospitals and sanitary trains.²⁰ In July, 1918, the group was divided into the base hospital group and the evacuation hospital group, each having its own camp site. Fifteen evacuation hospitals and several hospitals trains were formed in Battalion No. 14 and the hospital group prior to this date.²⁰

The base hospital group organized base hospitals, convalescent camps, and convalescent depots, and also furnished a large overseas replacement unit. There were organized and forwarded from the group 63 base hospitals and 11 convalescent camps; 14 base hospitals and 6 convalescent depot sections were formed but did not leave camp.²⁰ The organization of the group consisted of: Headquarters; supply department; mess department; camp infirmary; sanitary inspector; recruit section; hospital section.²⁰

Headquarters.—The commanding officer, adjutant, personnel adjutant, and three headquarters companies, to which the permanent cadre and casuals were assigned, constituted headquarters. When the group was divided, Headquarters Company No. 3 was transferred to the evacuation hospital group together with the evacuation hospitals and hospital trains already formed.⁶

The personnel adjutant had an assistant, and a relatively large office force was found necessary to handle promptly the records of the men who passed through the group. During its most active week 37 different organizations entrained and left the group.⁶ The paper work incident to this movement was very great, and was accomplished in a satisfactory manner.²⁰ An especial effort was made to have the service records and pay cards complete and accurate before they were forwarded. From various causes they were often defective when received, and this was a source of much trouble.²⁰

Supply department.—The group supply officer was accountable for the local camp property; issued clothing and equipment to the different organizations; paid the troops, and cooperated with the Camp Greenleaf troop-movement officer in arranging transportation for outgoing organizations. Several warehouses were used to store the necessary clothing and equipment. A special room was devoted to fitting shoes.²⁰ Motor trucks were assigned to the group and reported from the motor group when needed. Animal-drawn transportation and a number of saddle horses were kept in the group stables.

Mess department.—A group mess officer was appointed from the permanent cadre, with supervision of all messes and purchase and issue of stores. Subsistence stores were drawn from the central depot on a consolidated ration return for the group, or purchased in open market, kept in a special storehouse and

issued to the local messes.²⁰ A number of well-qualified cooks were part of the permanent cadre of the group. When a new organization was formed, two of these cooks were temporarily assigned to it, and they trained and assisted the cooks of the unit, which also furnished the kitchen police. The same bill of fare was served in all messes. Organizations which were designated to complete their training at Camp Greenleaf were required to operate their messes and manage their mess funds. All mess funds were audited monthly by a board of officers appointed from the group headquarters. Organizations leaving the group were given their pro rata share of the general mess fund, and were required to certify that they had no outstanding debts.²⁰ The group surgeon had charge of the infirmary and held sick call. All hospital cases were transferred to General Hospital No. 14, Fort Oglethorpe. The physical examinations of the men, which were frequently made, were made by the officers of the different organizations. The influenza epidemic of the fall of 1918 called into being a large tent isolation camp, which was set up adjacent to the group camp, and operated by officers and men detailed from the group. From this hospital only the severe cases were transferred to General Hospital No. 14, and there were no local deaths.²⁰ The sanitary inspector supervised the sanitation and police of the camp and the operation of refuse incinerators. Garbage was hauled away by a contractor. Extensive work in ditching, filling, and oiling was done for mosquito control. The commanding officer of each organization was made responsible for the sanitation and police of the barracks occupied by his men and also the mess hall and kitchen. Food waste was rigidly controlled by checking the amount of food issued to the mess and the amount of garbage. An examination for carriers was made of cooks and other handlers of food, and a hookworm survey was made of men coming from infected districts. With the exception of the influenza epidemic of October, 1918, the general health of the command was excellent.²⁰ All cases of contagious disease were promptly removed and isolated, and the men in the barracks from which the case was taken were quarantined as a unit, drilling and messing apart from the rest of the command.

Recruit section.—The administrative organization of the group was developed and modified to meet the changes which occurred in the camp at large, and the duties devolving on the group. At first a recruit section was maintained at which recruits were held and outfitted before being assigned to their organizations. Later, when the detention camps and replacement group at Camp Greenleaf handled all of the inducted men, the recruit section functioned, with a reduced personnel, as a receiving section, and enlisted personnel for the formation of new units was requisitioned from the replacement group.²⁰ A permanent cadre of officers and enlisted men was maintained and furnished the staff of the group and instructors for newly formed units.

Hospital section.—Base hospitals, convalescent camps, and convalescent depots were organized in compliance with orders from the War Department, which gave their numerical designation, prescribed their strength, and assigned the commissioned personnel.²⁰ Most of the units were organized at reduced strength and then sent to general hospitals about the country to complete their complement of men and receive practical training in hospital work. The

additional personnel required to bring them to full strength was obtained from the general hospital to which they were attached, or, in several instances, forwarded from Camp Greenleaf.²⁰ Delay in appointing the commanding officer and administrative staff of a new organization, and their absence when the unit was formed, was a handicap frequently encountered. These officers were appointed but often did not join their organization until after it had left Camp Greenleaf.²⁰ When the group received orders to form a new unit, the enlisted personnel was requisitioned from the replacement group, a provisional staff of officers, noncommissioned officers, and cooks was detailed from the permanent cadre of the group, and intensive training was begun immediately. Due to the fact that units left the group at irregular intervals, and often very quickly after they were organized, no set schedule could be maintained. In general, however, the forenoon was devoted to drill and one lecture and the afternoon to a hike, during which practical work was done in litter bearing and first aid and instruction given in sanitation and personal hygiene. Officers and noncommissioned officers were instructed in the preparation of records, official correspondence, supply, and mess management.²⁰ A guard was mounted daily, and the fire apparatus was manned by a special detail.²⁰ Athletics were encouraged, and physical training under a special instructor given daily. Numerous baseball and football games were played between teams in the group and teams from other groups. A large covered stage was built, and in the evenings boxing and wrestling matches were held, and vaudeville acts put on by local talent or teams from Camp Greenleaf.²⁰

The group ceased to function in December, 1918, preceding which date large detachments were forwarded to man three newly formed general hospitals.²⁰

The following base hospitals were organized at Camp Greenleaf:²¹ Base Hospitals Nos. 51, 52, 53, 55, 56, 57, 59, 60, 61, 62, 63, 64, 69, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 91, 92, 98, 100, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 123, 124, 125, 126, 127, 128, 129, 130, 132, 133, 134, 135, 136, 137, 138, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, and 161.

MOTOR GROUP

On July 1, 1917, 800 enlisted men and 40 medical officers were assigned by orders from camp headquarters of the Medical Officers' Training Camp, Fort Oglethorpe, Ga., for the formation of ambulance companies and field hospitals.²² The instructions directed the formation of animal-drawn and motor companies in equal numbers, and six ambulance companies were organized and equipped in six weeks. At the termination of the first six weeks period, orders were received to send the companies already organized to the various camps, where divisions were being formed, retaining a small percentage of the officers and men as a nucleus for additional companies. The original number of officers and men had been reinforced by additional allotments. Six additional field hospitals and six additional ambulance companies were begun at once on the basis of two animal-drawn to four motor vehicles.²²

On November 1, 1917, the field hospitals and ambulance companies were combined to form a sanitary units battalion.¹⁹

About this date, a number of the companies of the second group organized, were sent to camps, as a basis for the formation of divisional sanitary trains, and on November 25, 1917, several ambulance companies and field hospitals joined the camp from Fort Benjamin Harrison.²² At this date, the command was separated, so that the animal-drawn units, which constituted one-third of the command, became a separate section of the camp, and the motor units formed a section which was called the motor camp, Camp Greenleaf.²² At this same time the motor units moved to another part of Chickamauga Park, taking over one-half of the reserve officers' training camp, Camp Forrest. There were then 12 field hospitals and 12 ambulance companies, motorized, and 4 evacuation ambulance companies, motorized, in this group.²²

On January 7, a department of transportation was organized and divided into three parts: First, a school of motor instruction; second, a repair shop; and, third, a service department.²³ A permanent working force of noncommissioned officers and mechanics was transferred from the various companies for duty in the motor department. Truck, ambulance, motor car, and motor cycle drivers were detailed semimonthly from the various companies for four weeks' duty in the motor department. These men took care of the routine work of Camp Greenleaf and Camp Greenleaf annex, and constituted the service department.²³ The repair department and the school for motor instruction jointly did the repair work for the transportation assigned to this command.²³ The school of motor instruction was intended to instruct truck drivers who had graduated from the service department in handling the trucks assigned to their organizations. The school also instructed ambulance and truck repair men in making minor repairs, replacing broken parts, and locating trouble in unserviceable cars. The purpose of this school was to insure that every motor company leaving the command would have its full quota of repair men and chauffeurs. Special instruction was given motor-cycle operators and repair men.

At this time the field hospitals and evacuation ambulance companies battalion, consisting of 8 field hospitals and 2 evacuation ambulance companies, were in training.²⁴ These companies were taught proficiency in the school of the soldier, litter bearer drill, tent pitching and striking, individual cooking, transmission of messages, first aid, and the establishment and operation of complete field hospitals and stations for slightly wounded. Practice marches were also held. In addition, schools were conducted for instruction in operating-room technique, pharmacy, ward management and nursing, the administration of drugs, truck and ambulance driving, including the care of equipment and making repairs.

Schools for noncommissioned officers were in operation for instruction in administration, property, mess management, and sick and wounded report.²⁴ Evening talks and demonstrations were given to the enlisted men. Interesting articles were read to them and effort made to direct their minds in proper channels. French classes were conducted for both officers and enlisted men.

An advanced school for officers was conducted by this group, and two hours each day were devoted to lectures.

A camp infirmary was operated under the direction of the field hospitals.²⁴ A ward was connected with the infirmary for the care of the sick in quarters,

where the men were taught the principles of ward nursing. Two officers were assigned by roster each day to assist the camp surgeon in taking sick call. These officers were taught the management of sick call and details of the sick and wounded reports.

To secure the necessary flexibility of schedule, to permit the necessary preparation for exercises, and to provide against waste of time, 165 hours were assigned to the ambulance companies, as follows:²⁵

	Hours
Allotted to drill and field work.....	120
Allotted to demonstration and deductive teaching.....	45
Total.....	165

Each company which had more than its tabular quota of officers detailed one personnel officer whose duty it was to attend all didactic lectures and assist in all demonstrations and practical class work. He reported to the company commander upon the work of the class and upon individuals who attracted attention for any reason. In the absence of such an officer, the sanitary officer of each company assumed these duties.

An informal written quiz was given at the close of each week covering the subjects taught during the week.²⁵

The company commander was responsible for the use of all available time, adapting instruction to conditions as they arose.²⁵ He assigned the drills and subjects of instruction at least one week in advance in order that no officer would be obliged to conduct a lecture, drill, or demonstration without ample preparation. He was responsible for maintaining a proper sequence and balance of instruction, and to this end kept a daily log of instruction and drill, which was open to inspection at any time. The company commander also kept an individual record of (a) previous education, (b) special qualifications, (c) ability, (d) class work, besides any special data which he might wish to compile. This record was made in consultation with junior officers and first sergeant.

Drills: ²⁵	Hours
1. Setting-up exercises.....	12
2. Foot drill (school of the soldier, school of the squad, company drill).....	30
3. Field exercises (route marching, camp pitching, battle service).....	27
4. Litter bearer and ambulance drill.....	10
5. Shelter-tent drill.....	10
6. Pyramidal and wall-tent drill.....	8
Total.....	120

Didactic and demonstrations:²⁵

1. Articles of War.....	1
2. Military discipline and courtesy.....	1
3. Camp regulations.....	1
4. Personal hygiene and care of the feet.....	1
5. Venereal prophylaxis.....	1
6. Infection and disinfection.....	1
7. Means of transmission and prevention of disease.....	1
8. Camp and field sanitation.....	1
9. Water, air, and ventilation.....	1
10. Outline of sanitary service in war and functions of an ambulance company.....	1
11. Equipment of a sanitary soldier.....	1

Didactic and demonstrations—Continued.	Hours
12. Care of equipment and property.....	1
13. The skeleton, muscles, skin.....	1
14. Nervous system and special senses.....	1
15. Digestive apparatus.....	1
16. Blood and circulation (lymph system).....	1
17. Respiratory and excretory apparatus.....	1
18. Principles of first aid; emergencies, contusions, wounds.....	1
19. Hemorrhage.....	1
20. Dislocations and sprains.....	1
21. Fractures.....	1
22. Insensibility.....	1
23. Asphyxia and resuscitation.....	1
24. Gas.....	1
25. Bandaging and nursing.....	8
26. Improvised splints and litters.....	1
27. Allen's methods.....	1
28. Field cooking.....	1
29. Guard duty.....	1
30. Messages.....	1
31. Semaphore signals.....	3
32. Weekly written quiz (½ hour).....	3
Total.....	45

Early in February, unfortunately for training, it was necessary to send many men from this camp, the command losing about 40 per cent of its enlisted personnel. Numerous details made necessary by road construction, the hauling of fuel, and the construction of a new tent camp for a prospective influx of recruits, brought formal company instruction of these companies to a standstill.²⁵

In April, 1918, the question of the large number of motor drivers and mechanics required for the Medical Department was very carefully considered,²⁶ and brought forth the following correspondence:

HEADQUARTERS MOTOR SANITARY UNITS,
Camp Greenleaf Annex, Chickamauga Park, Ga., April 18, 1918.

From: Commanding officer.

To: Surgeon General, United States Army, Washington, D. C.

(Attention Colonel Munson, through the Commandant, Camp Greenleaf).

Subject: Motormen required for Medical Department.

1. Complying with verbal instructions of the officers addressed, an estimate of the number of motormen required for the Medical Department is hereby submitted. This estimate is based upon a proposed strength of 200,000 enlisted men in the Medical Department, and is computed with the view to the needs of an Army extending from the firing line to base:

(1) Ambulance drivers.....	10, 000
(2) Truck drivers.....	8, 000
(3) Mechanics.....	5, 200
(4) Motor-cycle drivers.....	3, 400

M. ASHFORD,
Lieutenant Colonel, Medical Corps, U. S. A.

[First indorsement]

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., April 24, 1918.

To the SURGEON GENERAL OF THE ARMY
(Attention Colonel Munson).

1. Forwarded, approved. It is believed that this estimate is as accurate as can be determined at the present time.

H. P. BIRMINGHAM,
Colonel, Retired, Commandant.

[Second indorsement]

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
April 29, 1918.

To Colonel WOLFE, *Supply Division*.

1. Referred with request that he comment on the above estimate. This estimate was made as a result of a request by me to the officers at Fort Oglethorpe who have charge of motor work, that they make suggestions as to the number of men who, in their opinion, should be trained in gas engine and chauffeur work for service in the Medical Department.

2. Based on your wishes in the matter, we desire to establish at the M. O. T. C., Fort Oglethorpe, such facilities as will produce in a given time such proportion of total required as may be necessary to meet current needs.

By direction of the Surgeon General:

E. L. MUNSON, *Colonel, Medical Corps*.

[Third indorsement]

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
May 13, 1918.

To Col. E. L. MUNSON, *Medical Department*.

1. Returned.

2. The Medical Department will have in operation by June 30, 1919, according to the proposed expansion of the Army, tentative strength table, serial No. 10-D, compiled March 19, 1918, by R. W. T., approved, M. C. L., March 19, 1918: 5,808 ambulances, 3,473 motor cycles, 1,700 motor trucks, 500 touring cars.

3. In order to provide a sufficient number of drivers for these vehicles, there should be available by that time 15,000 ambulance drivers, 8,000 motor-cycle drivers, 7,000 truck drivers, 500 touring-car drivers.

4. This will require the training of 1,200 ambulance drivers, 650 motor-cycle drivers, 600 truck drivers, and 40 touring-car drivers per month from June 1, 1918, to June 30, 1919. This gives a total of approximately 2,500 to be trained each month.

5. Allowing two mechanics for each motorized ambulance company and each motorized field hospital, will require approximately 500 during the same period for duty with the respective companies. There should be available at least 200 additional to care for motor vehicles of base and evacuation hospitals, regimental and other organizations whose machines are not kept in repair by ambulance company and field hospital company mechanics.

EDWIN P. WOLFE.

[Fourth indorsement]

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
May 14, 1918.

To Col. E. L. MUNSON, M. C.,
M. O. T. C., Fort Oglethorpe, Ga.

1. For comment and suggestions.

[Fifth indorsement]

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., May 18, 1918.

To Col. HENRY PAGE, M. C., U. S. Army, and to Lieut. Col. MAHLON ASHFORD, M. C., N. A.

1. Forwarded in turn for comment and return to these headquarters.

[Sixth indorsement]

HEADQUARTERS MOTOR SANITARY UNITS,
Camp Greenleaf Annex, Chickamauga Park, Ga., May 20, 1918.

To Col. HENRY PAGE, M. C., U. S. Army.

1. That portion of Camp Greenleaf, formerly reserve officers' training camp and now designated as Warden McLean division, medical officers' camp, is now assigned to motor sanitary units. These cantonments, together with outlying tent camp, have an approximate capacity of 4,000 men, which is ample to supply the Medical Department with the quota indicated by Colonel Wolfe, provided the requests from this office are granted.

2. The purpose of this special portion of Camp Greenleaf is considered by me to be the following:

To receive all enlisted personnel intended for motor training; uniform, examine, equip, vaccinate, classify said personnel; give a preliminary training during period of equipment and classification; and send out men under one of the following classes: (a) For base machine shops or base repair work, (b) field repair men, (c) competent drivers and emergency repair men, (d) exigency drivers, (e) men unfit for motor department or overseas for any reason whatsoever.

3. I am in favor of sending all Medical Department enlisted men who are intended for motor work to this camp for the preliminary training outlined above. When this has been given, the men will then be available for transfer to the base shops; for filling the proper percentage of motormen on replacement drafts overseas; for supplying motormen to motorized sanitary units and for the necessary motor service and repair work in this large camp. The decision as to the location and conduct of base repair schools and shops is conditional upon a number of factors which do not concern me, and I therefore make no recommendation except that the men for this department could well be sent through this camp prior to assignment to base shops and, further, that the base shops could well be run as an independent unit whether they are placed here or elsewhere.

4. Attention is again invited to recommendations from this office which may briefly be summarized as follows:

(a) That this command receive all men having any knowledge of motor vehicles, as soon as they have entered Camp Greenleaf.

(b) That the commanding officer of this camp be permitted to retain and instruct the men thus received for a definite period, not less than four weeks in any case.

(c) That future requests from the War Department for transfer of enlisted men show specifically the percentage of automobile field mechanics, truck drivers, ambulance drivers, and motorcycleists desired, and that this department furnish only such specified portion of said draft.

(d) That the supply department be enabled to secure its supplies in the most direct manner possible and not by requisition through tedious channels.

(e) That the estimates for expansion of this department previously forwarded be acted upon favorably.

5. This department will not be able to meet the requirements indicated by paragraph 4 of the third indorsement unless prompt consideration is given to the above recommendations and former requests for expansion. The strongest argument in my opinion for a separate establishment for the motor department is that its personnel would not be subject to indiscriminate draft as it has of necessity been in the past.

M. ASHFORD,
Lieutenant Colonel, Medical Corps, N. A.

[Seventh indorsement]

HEADQUARTERS, CAMP GREENLEAF,
Chickamauga Park, Ga., May 23, 1918.

To the SURGEON GENERAL OF THE ARMY.
 (Attention Colonel Ashburn.)

1. Returned. Attention invited to the sixth indorsement, which is concurred in, other than the examinations referred to in paragraph 2, fourth line, will be made under the general service of physical examinations for Camp Greenleaf as a whole.

2. Instructions will be given to assign to the automobile and gas-engine school, motor group, all recruits claiming any knowledge of motor vehicles, as requested in paragraph 4 (a). The request made in paragraph 4 (b) is important, but can not be carried out, unless an adequate inflow of recruits is assured this camp.

The request made in paragraph 4 (c) is reasonable, and it is requested that it be complied with as far as possible.

3. It is believed that following the assignment here for duty of an officer representing the automobile section, supply division, Surgeon General's Office, no material difficulty will occur in producing such number of trained chauffeurs and gas-engine men as the Medical Department may require, subject, of course, to assignment to this camp of a sufficient number of recruits for training.

E. L. MUNSON,

Colonel, M. C., United States Army, Commandant.

To carry out these recommendations, in the early summer of 1918 motor specialists were sent to Camp Greenleaf and every effort was made to furnish these needed drivers and mechanics.²²

The motor group, in addition to forming ambulance companies, field hospitals, and evacuation ambulance companies, all strictly motor units, formed two convalescent hospital units, and one convalescent depot. Also many hundred recruits were received and organized into replacement units of 250 men each and sent overseas as such.²²

As the summer of 1918 progressed, the work in the motor group became much more varied, and several distinct activities were carried on. The first function of the motor group was to receive, examine, and classify, as they were sent to Camp Greenleaf, all enlisted men having knowledge of motor equipment. Highly trained specialists in the repair and operation of motor equipment were placed on duty as instructors in the motor school, and from their number requisitions for men of this type were filled. Pending assignment, these men served as instructors and as specialists in the repair and upkeep of the motor equipment of the camp. Highly skilled chauffeurs were classified and utilized in the same manner as already described for mechanics. Average mechanics and chauffeurs were given special training in the motor school and upon graduation were assigned to outgoing units, according to their needs. The supply of men with some knowledge of motor equipment never fell below the requisition made.

The second function of the motor group was to operate a school for motor-men. This school was organized in January, 1918.²² In the early summer of 1918, the War Department sent three specialists (Sanitary Corps officers) to operate this school. These men were highly trained specialists in motor equipment, of whom one had been instructor in that work at the University of Michigan. Through their efforts the work of instruction was coordinated and improved, so that a very excellent motor school was operated. From this school highly trained mechanics and specialists in every phase of motor equipment were graduated. Large classes of trained chauffeurs and motor-cycle operators were also instructed. Mechanics were classified "A" and "B," "A" class being men who could do any form of base work, and "B" men who were qualified to do field repair work on the standard trucks, ambulances, and motor cycles used by the Army. Drivers were trained to operate trucks, ambulances, and motor cycles. The officers assigned to motor units were similarly trained. This school succeeded in graduating a sufficient personnel to meet requests received at camp headquarters.

The third function was to operate all motor equipment for the medical officers' training camp and to supply, in emergency, additional equipment for the line camp, which was at the same station.²² The medical officers' training camp gradually rose in numbers from a few thousand to approximately 30,000 men. The line camp gradually receded from approximately 25,000 men to approximately 10,000 men. With this increase in the troops, the motor equipment rose, so that the motor group operated approximately 50 motor cycles, 12 touring cars, 60 ambulances, and 100 trucks. In October, 1918, an inspector of the Motor Transport Corps inspected the equipment of the camp and reported that the motor equipment was in the best condition of any camp in the United States which he had visited.²² Less than 4 per cent of the equipment was in need of repair and not operating at the time of his unannounced visit. At this time only 60 per cent of the trucks of an adjacent camp were operating.

The fourth function was to send out trained motor units, such as motor ambulance companies, field hospitals, and evacuation ambulance companies.²² After the departure of the six motor companies assigned to the 7th Division, in the early summer of 1918, 20 evacuation ambulance companies, 2 ambulance companies, and 2 field hospitals were formed and sent out. A complete sanitary train was also formed and was ready for departure at the time of the signing of the armistice.²²

The fifth function was the formation of replacement units.²² This became a major function of the camp in the summer of 1918. The units were formed and sent out on an average time of five weeks after drafted men reached the camp in their civilian clothes. These men were organized into units of 250 men, with a specified number of men of each trade or calling. They were examined medically and physically, vaccinated, equipped, and given elementary military instruction. On the average, four such units were sent out from camp each month during the summer and early fall of 1918.²²

The sixth function was to receive and care for all soldiers received at Camp Greenleaf in whom hookworm was discovered. A group of about 800 of these men was maintained, so that during the spring and summer of 1918 several thousand hookworm infected men were received and cared for. The majority of these men were cured, organized into units, and sent overseas.²²

The seventh function was developed in the summer of 1918, when all venereals received in Camp Greenleaf were accepted by the motor group.²² These men were segregated, treated, and, when cured, placed in outgoing units.

The eighth function was to receive colored men and organize them into labor companies for the Medical Department, of which approximately six companies were sent overseas as replacement units of 250 men each.²²

The ninth and last function was the training of emergency officers.²² These officers were received after a few weeks training at the medical officers' training camp and were assigned to the various units of the motor group, for active experience in handling troops under field conditions. The number of officers under training at no time exceeded 200.

The motor group rose in strength, from 400 men in July, 1917, to approximately 8,000 men in the summer of 1918.²² The organization at that time was

well perfected for the training of officers, noncommissioned officers, and enlisted men; for the receipt of large bodies of drafted men and their classification, equipment, and organization into military bodies.

The following schedules graphically illustrate the instruction carried out for the different units of the group:

SCHEDULE A ²⁷

[Designed for first two weeks' instruction of recruits assigned to motor companies]

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 to 6.45 a. m.	This period will be devoted to setting-up exercises entire week					
8 to 9.15 a. m.	School of soldier, squad, or company	School of soldier, squad, or company	School of soldier, squad, or company	School of soldier, squad, or company	School of soldier, squad, or company	Inspection
9.30 to 10.30 a. m.	Litter drill one week and litter-ambulance drill second week, except Saturday					
10.45 to 11.45 a. m.	School of soldier, squad, and company entire week, except Saturday					
1 to 2 p. m.	Shelter tent drill	Ward hospital tent drill	Shelter tent drill	Ward, pyramidal hospital tent drill	Shelter tent drill	
2 to 3 p. m.	First aid and bandaging	Pyramidal and wall tent drill	First aid and bandaging	Ward, hospital pyramidal and wall tent drill	First aid and bandaging	
3 to 4 p. m.	Lecture	Lecture	Lecture	Lecture	Cleaning equipment	
4 to 4.15 p. m.	This period for guard mount and retreat					
4.15 to 6 p. m.	This period will be devoted to athletic games entire week, except Saturday					
6.30 to 7 p. m.	French instructions for company officers, Battalions 1 and 2, except Saturday					
7.30 to 8 p. m.	Mass singing		Mass singing			Mass singing

SCHEDULE B ²⁸

[Designed for second two weeks' instruction of recruits assigned to motor companies]

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 to 6.45 a. m.	Setting-up exercises	Setting-up exercises	Setting-up exercises	Setting-up exercises	Setting-up exercises	
8 to 9.15 a. m.	School of soldier, squad, and company	School of soldier, squad, and company	School of soldier, squad, and company	School of soldier, squad, and company	School of soldier, squad, and company	Inspection
9.30 to 10.30 a. m.	First-aid bandaging, minor surgery	Bearer drill without litters	First-aid bandaging, minor surgery	Bearer drill minor litters	First-aid bandaging minor surgery	Inspection
10.45 to 11.45 a. m.	School of the company	School of the company	School of the company	School of the company	School of the company	Inspection
1 to 2 p. m.	Company lecture noncommissioned officers' school, officers' school ^a	Company lecture noncommissioned officers' school, officers' school ^a	Company lecture noncommissioned officers' school, officers' school ^a	Company lecture noncommissioned officers' school, officers' school ^a	Company lecture noncommissioned officers' school, officers' school ^a	Recreation
2 to 4 p. m.	Field exercises, ^b combining litter drill, ambulance litter drill, bearer drill without litter, first-aid, bandaging, rendering first-aid, using gas masks, establishment of dressing stations, pitching field hospital tents				Cleaning equipment	Recreation
4 to 4.15 p. m.	Guard mount and retreat	Guard mount and retreat	Guard mount and retreat	Guard mount and retreat	Guard mount and retreat	Guard mount and retreat
4.15 to 6 p. m.	Athletic games ^c	Athletic games ^c	Athletic games ^c	Athletic games ^c	Athletic games ^c	Athletic games ^c

^a The company lecture will be delivered upon a subject designated by battalion commander.

The noncommissioned officers' school will be conducted under direction of battalion commander. Each company commander will designate a number of attendants, not to exceed 5 men.

The officers' school will be conducted by battalion commander, who will devote one-half this period to administrative instruction and one-half to instruction in French.

^b This 2-hour period enables the battalion commanding officer to give practical field exercises under conditions simulating present war condition. The elasticity of this scheme permits and expects exercise of judgment and zeal in making this a period of the greatest usefulness. Routine drills for this period are not in accord with spirit of this field exercise. Battalion commanders are authorized to arrange with motor transportation department ambulances and trucks for this instruction.^c Athletic games are to be by voluntary participation. Battalion and company commanders are responsible that every possible measure is taken to provide means for the usual American games; to organize and encourage baseball and other teams; and to arrange schedules. The group athletic officer is concerned in the arrangements for these exercises. Parsimony is discouraged with reference to judicious expenditure of company funds for athletic games. Purchases can be made at cost through post exchange. The idea of compulsion or compulsory attendance is forbidden. Men must be encouraged but not compelled to participate.

SCHEDULE C ²⁹

[Replacement and similar units]

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 to 6.45 a. m.	Setting-up exercises					
8 to 9.15 a. m.	School of the soldier, squad, or company					Inspection
9.30 to 10.30 a. m.	Physical drill	Litter ambulance drill	Physical drill	Litter ambulance drill	Physical drill	
10.45 to 11.45 a. m.	Litter drill	Litter ambulance drill	Litter drill	Litter ambulance drill	Litter drill	
1 to 2 p. m.	Shelter tent drill		Pyramidal tent pitching	Shelter tent drill		Group games
2.05 to 3 p. m.	First aid and bandaging		Pyramidal tent pitching	First aid and bandaging		Group games
3 to 4 p. m.	Lecture course					Group games
4 to 4.30 p. m.	Guard mount and retreat					
4.30 to 6 p. m.	Company games: Volley ball, indoor baseball, cage ball, baseball, quoits					

SCHEDULE D ³⁰

[For reservists]

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 to 6.45 a. m.	Setting-up exercises					
8 to 9.15 a. m.	Physical drill	School of soldier	Physical drill	School of soldier	Physical drill	Inspection
9.30 to 10.30 a. m.	First aid and bandaging	First aid and bandaging	First aid and bandaging	First aid and bandaging	First aid and bandaging	
10.45 to 11.45 a. m.	Litter drill					
1 to 2 p. m.	Lecture					
2.05 to 3 p. m.	Shelter tent drill	School of company	Shelter tent drill	School of company	Shelter tent drill	Group games
3 to 4 p. m.	Lecture					Group games
4 to 4.30 p. m.	Guard mount and retreat					Group games
4.30 to 6 p. m.	Company games					

Remarks: Swimming hours will be in accordance with special division hours. Company games—volley ball, indoor baseball, cage ball, baseball, quoits.

SCHEDULE E³¹

[Provisional ambulance companies, provisional hospital companies, evacuation ambulance companies]

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
6 to 6.45 a. m.	Setting-up exercises					
8 to 9.15 a. m.	School of the soldier, squad, and company					
9.30 to 10.30 a. m.	First aid and bandaging					
10.45 to 11.45 a. m.	Physical drill	Transport with- out litter	Physical drill	Transport with- out litter	Physical drill	
1 to 2 p. m.	Litter ambu- lance drill	Litter ambu- lance drill	Litter drill			
2 to 3 p. m.			Shelter tent drill			
3 to 4 p. m.	Lecture					
4 to 4.30 p. m.	Retreat and guard mount					
4.30 to 6 p. m.	Company games: Volley ball, indoor haseball, cage ball, baseball, quoits					

Remarks: Transport without litter will include trench work. Swimming hours will be in accordance with special division hours.

ANIMAL-DRAWN REPLACEMENT GROUP

At first all ambulance companies and field hospital companies were grouped together, but in November, 1917, the animal-drawn units were combined into what was called the animal-drawn group.¹⁹ Special training was commenced, and these units were for a short time stabilized to such a degree that by January 31, 1918, their training was estimated as 93 per cent complete.³²

On January 6, 1918, a stable company was organized on the basis of a troop of Cavalry to care for the horses and horse equipments (about 300 in number) used by the student officers.³³ These men also received instruction along the general lines for mounted sanitary soldiers. During the month of February, 1918, schools for farriers, saddlers, and horseshoers and blacksmiths were established. The abundance of clinical and other practical material contributed to the success of these schools. The purpose of these schools was to train as many men as possible to be sent outside of the camp, and to fill any of the above positions in organizations formed in the camp. In February, 1918, most of the organizations lost a large part of their trained personnel by transfer to replacement and other units.

When the group was first formed the men were quartered in that part of the camp formerly occupied by the 80th and 81st Artillery on a hill at the rear the original medical officers' training camp.³⁴ On April 29, 1918, the group was transferred to the camp recently occupied by the 11th Infantry, just back of the Dyer House, near Lytle, Ga.³⁵

The stable company of this group was disbanded on May 13, and the horses and equipment were taken over by Veterinary Company No. 1.³⁵

During April, 1918, men from the draft were received in this group and the organizations were temporarily filled to their proper quota. The demand for

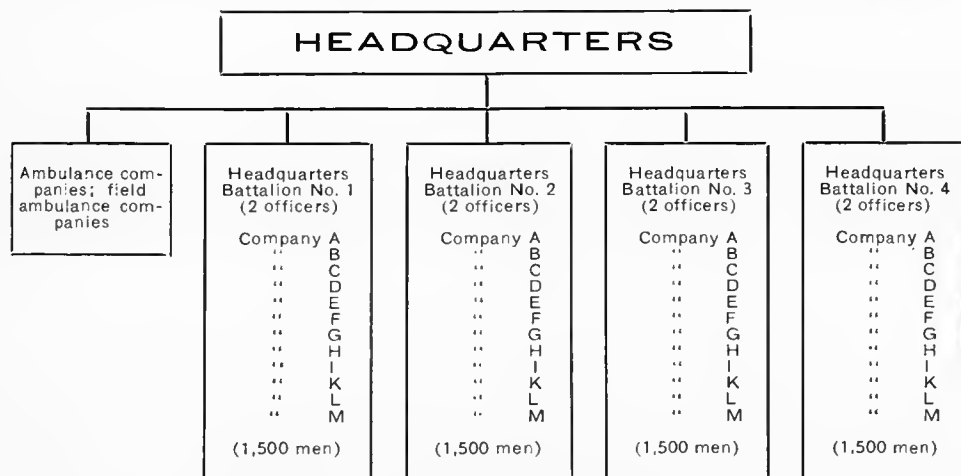
replacements was so great that this condition did not continue long, and large numbers of men were sent out during May, 1918.³⁵

In August, 1918, the animal-drawn group was again reorganized and became the replacement group.³⁶

The cooperative functioning of the detention group and the replacement group made the handling of the large number of new recruits much simpler and more efficient than previously.³⁷ The work of the replacement group was primarily the assimilation and distribution of the enlisted personnel released from the detention group, and was expanded to include their further classification into groups adapted to meet the requirements of the various sanitary units constantly in process of organization. The men, newly accepted into this section, were classified into six divisions, determined by their occupational and physical qualifications. Promising material was first selected for the Noncommissioned Officers' School; motor drivers, mechanics, and men of kindred trades were transferred to the motor group; men who had had the proper training or desired such instruction were assigned to the School for Cooks and Bakers; those experienced in clerical work, pharmacy, nursing, or similar occupations were sent to the hospital group; the remainder were divided according to their physical qualifications into general service men and domestic service men, and were held for training. This system facilitated the selection of the specially qualified men required by the various sanitary units and conserved man power by placing each man in the position where he could be of greatest value to the service.

The reorganized replacement group consisted of 4 training battalions, 2 provisional field hospitals, 2 provisional ambulance companies, 1 development battalion.³⁸

The scheme of organization can be best shown by the following diagram:³



The men in the training battalions usually came direct from Battalion No. 15, where they had spent two or three weeks after joining camp.³⁹ In some instances, however, as when more inducted men came to camp than could be accommodated in Battalion No. 15, they had to be taken right into the training battalions without any preliminary training. The men were organized

into companies and battalions, and were instructed in the duties of the soldier, school of the squad, sanitary drill, personal hygiene, and, as far as practicable, in the important Articles of War, Army Regulations, and Mason's Handbook. The length of time the men remained in the battalions varied greatly and depended directly upon the exigencies of the service. The scheme was that the men should receive never less than one month of training here and if practicable more. Not infrequently many of the men were assigned to an organization within two weeks after joining a training battalion; obviously such men were imperfectly trained.

At first, when called upon for a number of men to be sent to some other camp for overseas service, the headquarters of the group would send to each company and direct them to furnish so many men. It was found, however, that this did not allow a balanced group to go out, as the company commanders would hold good men, and sometimes one group would go out consisting, for example, mostly of stenographers, another of carpenters, etc. After this was found out the following scheme was adopted:⁴⁰ Qualification cards of all the men were carefully gone over and grouped according to their qualifications; when replacement was asked for the personnel office of the headquarters of the replacement group would go over the cards and try to pick out a balanced number of men—so many clerks, so many carpenters, so many motormen, so many men for general or other duty. Later, when base hospitals, evacuation hospitals, and other units were being formed, the tables of organization as devised by the commanding officer at Fort Riley were used, and if the group was ordered to send four or five evacuation hospitals out the personnel office used the tables for these organizations, went through the classification cards and picked the men as to their classification. Of course, it was impossible at times to furnish all classifications as called for, but as soon as this scheme was started better organizations were sent out.⁴⁰ The training of the men went on daily from 6 a. m. until 5 p. m., with lectures and entertainments in the evening. The average stay of the men in the group was about 10 days; some men stayed only 2 days, while others stayed several months. Before leaving the men were given a very rigid physical examination and a very rigid examination of the equipment that was prescribed in orders. A scheme for laying out this equipment on their cots was devised, and the equipment of several hundred men could be examined in an hour by this method.

DEVELOPMENT BATTALION

This battalion was organized in July, 1918,⁴¹ pursuant to orders received from The Adjutant General of the Army.⁴² It was placed under the command of the commanding officer of the replacement group.⁶ It was first quartered in a tent area to the west of the main camp of the replacement group, but on account of the difficulty experienced in the feeding of these more or less disabled men the battalion was moved to a small cantonment situated on a hill overlooking the replacement group.⁴³ The latter location was ideal and, though the buildings provided did not furnish sufficient quarters for the men assigned to this unit, ample shelter was obtained by the establishment of a tent area in close proximity. These tents were floored and framed. As soon as the battalion

was formed all men in the camp coming under this classification were transferred to it.⁶ The commanding officer of the battalion instituted an excellent system of classification of these men, and the records kept were very complete.⁴⁴ Men were sent to the battalion by the various medical examining boards in the camp and on arrival they were immediately classified and placed under appropriate treatment.⁴⁵ At first most of the men were venereal and orthopedic cases, but later all types of men suitable for development work were received.⁴⁶ The total number under instruction at any one time was approximately 800.⁴⁴

On account of the great variety of cases undergoing development and the close personal supervision required, the commissioned personnel on duty with the battalion was never sufficient;⁴⁷ nevertheless the work done was excellent in character.⁴⁴ In spite of the large numbers of inducted men arriving at camp the passage of the developmental case through the battalion was sufficiently rapid to keep the strength of the battalion within reasonable limits.⁴⁴ The school of urology and the school of military orthopedics handled the venereal and orthopedic cases respectively and all other cases were taken care of by the permanent medical staff of the battalion.⁴⁶

The entire personnel was divided into two sections to facilitate the proper treatment of the cases. These sections were Company A, which included all of the orthopedic cases, and Company B, in which were all of the remaining men.⁴⁴

Considerable delay in obtaining proper shoes for the orthopedic cases was experienced at first but this was obviated by the establishment of a cobbler's shop at the battalion camp.⁴⁷

DETENTION GROUP

The detention group was first an integral part of the enlisted men's section of Camp Greenleaf, but a short time after the organization of the camp a separate section known as the recruit camp was started.¹⁹ All recruits were sent to this section and a regular administrative plan was worked out to handle these men as they arrived. Each recruit, on joining, was seen personally, and his qualifications were taken. He was then carded and assigned to a company as a private, private first class, or noncommissioned officer. The companies were made up of 100 men, consisting of 4 platoons of 25 men each. Each company had an acting first sergeant and four platoon leaders, picked from recruits or from men who had been retained and trained in camp. These men acted as drillmasters and instructors in discipline and duties of the soldier.¹⁹ Each company received from 7½ to 8 hours' training daily, and the prospective noncommissioned officers devoted 3 hours to paper work and the balance of the time to drill, privates and privates first class, to first aid and drill. Recruits who joined without a full outfit of clothing were issued additional clothing as quickly as it could be obtained, to bring them up to the requirements of equipment "C." Their typhoid inoculations and smallpox vaccinations were also completed when necessary.

When the camp first started, noncommissioned officers from the militia detachment in camp were assigned as drillmasters and instructors.¹⁹ Regimental detachments were formed later, men having been picked according to qualifications after a certain amount of training. They were drilled, instructed,

and disciplined by officers assigned to this camp for training as regimental medical officers and by prospective noncommissioned officers of detachments. The prospective noncommissioned officers attended school two hours daily with the regimental medical officers.

On October 31, 1917, the recruit camp numbered 937 men, present and absent, formed into 3 battalions of 4 companies each; it was officered by commanding officer, 1 officer as assistant and supply officer, and 3 battalion commanders.¹⁹ One of these, in addition, acted as police and sanitary officer and surgeon, and one as mess officer.

Officers ordered to this camp from the medical officers' training camp for instruction in paper work, administration, and the general duties of regimental surgeons, were assigned as company officers, attending lectures with prospective noncommissioned officers, for whom they acted as quiz masters; they instructed their respective companies in first aid and drill, and were responsible for reports, returns, and discipline of their companies.¹⁹

The administrative, supply, and teaching forces, as well as kitchen and office forces, were organized and trained from reserve officers and recruits, except one officer of the Medical Corps and one sergeant first class, Medical Department.¹⁹

The name of this group was changed, later in the year, to the Noncommissioned Officers' School group.⁴⁸ In addition to receiving and training recruits this group also trained noncommissioned officers and organized such small units as sanitary squads, convalescent camps, and mobile operating units.⁴⁹

A detention camp was organized on February 14, 1918, by the direction of the director of the hospital train group, to which organization the detention camp, was added as a subsidiary organization.⁵⁰ The plan was that the detention camp should receive the incoming recruits, largely voluntarily inducted into the service, with some Veterinary Corps men and a few regular Medical Department men, and to hold them during the period of incubation of the commoner epidemic infectious diseases. It was further planned that, while in camp, they should receive the elements of military training—school of soldier and school of detachment—together with some instruction in camp and personal hygiene. The very large amount of emergency road construction required in and about camp had necessitated large drafts upon the personnel of the companies, and the training, while it progressed in a very favorable manner, fell short of that which was originally designed. The average size of each company was approximately 187 men, with an average of 2.75 officers. The normal strength of the companies as planned was 200 men, with 4 officers.

In the spring of 1918 all of the recruit work, including the handling of the draft and the detention of recruits for the specified period of two weeks, was performed in what was known as the 15th Battalion.⁵¹ The name was changed later to the detention group. The work of this group is shown more fully later, in the description of the general training of enlisted men at Camp Greenleaf. The order organizing this section of the camp and outlining its duties follows:

General Orders, No. 52.

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., June 3, 1919.

1. A detention camp will be operated hereafter as part of the Camp Greenleaf recruit brigade.

2. The detention camp will be divided into sections, one or more of which will be successively occupied for the purpose as need may require.

3. For the present, the section to be first used includes the original corrals and stables of Camp Greenleaf, the present tent camps now occupied by Battalion 15, and the barracks formerly occupied by the 81st Field Artillery.

The sections to be later used will be specified hereafter.

4. As far as possible, recruits admitted to the detention camp will be quartered in tents, in order to break them into small groups and reduce the number of direct contacts.

Every measure will be taken to keep groups in detention separate from each other, and to limit their association through messing, bathing, and latrine facilities.

5. All recruits will, on arrival, be admitted to detention camp.

6. The period of detention will be 14 days, during which time each man will be carefully inspected by a medical officer to determine the presence of any communicable disease.

No soldier will be assigned to an organization or transferred from this camp prior to the termination of the detention period.

Any recruit found to have a temperature of 101° will invariably be isolated pending further diagnosis.

7. While in the detention camp, each recruit will have a survey made in his case, by officers of the Dental Corps under instruction in the dental school, as to the condition of his teeth and the probably amount of dental work necessary.

Recruits urgently in need of dental work will be given appropriate dental treatment while in detention camp.

8. Special microscopic examination of stools will be made in the case of recruits who present any appearance of hookworm infestation and who admit of having resided in a known hookworm district.

As soon as laboratory facilities permit, the stool of every recruit coming from a known hookworm district will be microscopically examined as a routine measure.

9. To assist in carrying out the necessary physical inspections, a sufficient number of student officers will be assigned, under the school of hygiene, as aids to the commanding officer of the detention camp for the purpose of making inspections concerning, and records of, cases of communicable disease.

These inspections will be made at hours which do not conflict with instruction specified for the basic course.

10. Assignment of recruits will be made from the detention camp to organizations, units, and detachments; the commanders of which will call upon the commanding officer of the recruit brigade for the number of men needed and will specify the qualifications and number of men in each class thereof, which are desired.

11. During the detention period, recruits will receive as much instruction as practicable, but will not be subjected to severe physical exercise while undergoing reactions from inoculations against smallpox, typhoid and paratyphoid fevers.

By order of Colonel Munson:

E. S. SLEDGE,
Major, M. R. C., Adjutant.

The Noncommissioned Officers' School, as part of the 15th Battalion, was discontinued on the 1st of August.⁵³ The reconstruction company had been discontinued, and those cases that had not completed treatment were transferred to the development battalion in the animal-drawn group.

The sole work of the organization at this time was the handling of recruits from the draft.⁵³ All men joining Camp Greenleaf passed through this battal-

ion, which was known as the detention camp, as directed in the above order, where they remained for a two weeks' period, were examined under direction of the camp surgeon, Camp Greenleaf, and were vaccinated, equipped, and given elementary training in the duties of a soldier. Thirty-two companies were organized. During the summer and fall of 1917, recruits were received from recruit depots, partially clothed and equipped. These were voluntarily enlisted men, some of whom had had former military training. It was rare to receive more than 200 daily, and the maximum number during this time never exceeded 1,000 men on the morning report. The selective-service men began to arrive in March, 1918. The size of the group gradually increased, and by July it included 7,500. The largest number on any morning report was: Officers, 80; enlisted men, 7,300. The total number joining in the month of July was something over 9,000. About 3,500 were quartered in tents and about 4,000 in horse sheds.

It was originally believed, and later proved to be correct, that centralization of all paper work, official records, clothing and equipment, and mess management was essential to efficiency, owing to the lack of properly trained commissioned and enlisted personnel and to the shortage of supplies.⁵³ The organization, as adopted in the fall of 1917, and expanded as the detention group increased in numbers and requirements, included the following:⁵³ Headquarters, central record office; supply department; mess department; the surgeon; section No. 1, Companies 1 to 16; section No. 2, Companies 17 to 32.

At the headquarters office all correspondence, reports, returns, and other paper work for the command were attended to, under the direction of the commanding officer, personnel adjutant, and assistants.⁵³ Officially, the unassigned recruit was a member of Battalion No. 15, the official designation of the organization, without the company to which he was assigned being designated. The commanding officer signed all correspondence and other papers, as would a soldier's company officer. The service records, pay cards, etc., were prepared and signed by the personnel adjutant or his assistant. One consolidated morning report for the command was rendered, made up from the individual company morning reports.

Group headquarters assigned all men to companies and designated what men would be transferred out of camp.⁵³ Muster and pay rolls were prepared, one for each company, and marked "Detachment roll No. 1, No. 2, No. 3," etc. A card index, containing all necessary data in regard to pay, muster, admission to sick report or return therefrom, and availability for transfer, was kept for all men, alphabetically arranged by companies. The cards representing losses were filed alphabetically for the monthly period in which they occurred, under appropriate headings, as transferred, deserted, died, the cause of the loss being stated on the card. A second card index giving each soldier's name, company to which assigned, and other data, was arranged alphabetically for the entire command. This was found essential for the purpose of locating men at given times. Service records, pay cards, and all other records pertaining to the soldier, except the equipment record, after completion were filed alphabetically for the entire command.

SUPPLY DEPARTMENT

The group supply officer was accountable for all property in the group.⁵³ Each company commander was responsible to him for his tentage, cots, bed sacks, and other company property. The mess officer was responsible for all mess equipment used in the organization. The supply officer, after fitting the recruit, made all issues of clothing and other personal equipment, when it could be obtained. He completed the equipment records and retained them until the soldier was transferred. The company commander verified the fitting and issue of clothing and equipment to his company.

MESS DEPARTMENT

All messes in the organization were run as one.⁵³ There was one mess fund and one company fund, for which the mess officer was responsible. The ration allowance was drawn on the consolidated morning report. The mess storehouses were established, one centrally located in each section of the camp, from which the daily supplies were issued to each kitchen. The mess officer, with one commissioned assistant, did all the buying, superintended the issues, was responsible, as stated above, for all mess equipment used, and was responsible for the preparation and serving of all meals. Each company had its own mess hall and kitchen, many of which were temporary, using field ranges. Three cooks were assigned to each kitchen, with a mess sergeant to every three messes, all directly under the mess officer.

The company commander detailed all necessary kitchen police and inspected the mess daily.⁵³ The mess officer was responsible for the police in the kitchen and mess hall. Food waste was stopped by placing one of the kitchen police on guard over the garbage can, allowing nothing to be thrown away that was edible. Mess kits, after being washed by the soldier in hot soapsuds, were dipped into boiling water and were thus sterilized and dried. Three camp kettles of boiling water, kept boiling during the meal hour, were located at each kitchen. Burned-out boiling plates from discarded field ranges were reinforced with strips cut from old steel escort-wagon tires and set up with a Sibley stove at one end. A fire was kindled underneath and three camp kettles kept boiling on the top. The same menu was served in each of the 33 messes daily.

THE SURGEON

The company officers were medical officers. Every recruit was daily inspected for infectious diseases during his first two weeks in camp, by one of his company officers.⁵³ All suspects were sent at once to the surgeon. When a case of infectious disease occurred, the patient was transferred to General Hospital No. 14. The contacts, those quartered in the tent with him, were removed, bag and baggage, to another tent in a section of the camp set aside for isolation, and were held there during the incubation period of the disease. While in isolation the soldier continued his training and was under the direct supervision of the surgeon. A hookworm survey was made on all men arriving from that part of the country where the disease was known to be endemic, necessary specimens being collected under the supervision of the surgeon and sent to the general hospital laboratory. All venereal cases arriving, or devel-

oping later, were assigned to one company and treated under the surgeon's direction. Only very acute or complicated cases were transferred to the hospital. The surgeon completed the smallpox, typhoid, and paratyphoid vaccinations, the companies being marched to the infirmary at the appointed time. He completed and filed all vaccination records, reporting the results, as completed, to the headquarters office for entry on service records. He held sick call for the command and prepared the sick and wounded and sanitary reports and rendered daily to the headquarters office the surgeon's consolidated morning report of sick. The company officers made the semimonthly physical inspections of their individual companies.

COMPANY ORGANIZATION

The companies were grouped into two sections, with an officer designated as the tactical director in charge of each, acting as would a battalion commander. The tactical director represented the commanding officer and was directly responsible to him for all the training, discipline, sanitation, and police of the companies in his section. He kept no office of record.

COMPANY ADMINISTRATION

The strength of the companies varied from day to day.⁵³ The maximum strength, depending upon the housing capacity, ranged from 200 to 250 men. The officers were assigned from the medical officers' training group, and unfortunately were frequently changed and lacked training as company commanders. Two officers, when available, were assigned to each company. The company was divided into platoons of 50 men each, with a platoon leader belonging to the permanent training cadre assigned to each platoon. One platoon leader acted as first sergeant of the company. The company commander kept a morning report and roster of his company. No other paper work was done in the company. The brunt of the training of the recruit fell upon the platoon leader. These men were given warrants and promoted as rapidly as they showed their ability to train others. None was promoted to fill vacancies. Promotion was given only for proved merit; demotion, therefore, was very rare.

The following was the routine devised and carried out on the arrival of men for training.⁵³

Prior to arrival, lists were received showing date of expected arrival of trains, with routing, and number of men from each local draft board traveling on each train. The assignment of men to companies was so made as to keep each local board's group intact, so far as possible. The companies receiving men were depleted of all men except the training cadre. Tentage, cots, and bedding were made ready for occupancy the day prior to the arrival of new men.

The train was met by the tactical director of the section and by the company officers and noncommissioned officers of the companies to which the men had been assigned. The men were detrained, and the recruit from each local board designated as captain was directed to collect the men of his local board. The men as assigned to a company were lined up in column of fours, counted and marched past an empty truck, in which they placed their baggage. The company and truck then proceeded to camp. In this manner all men were

formed into companies, counted, and the number of men received from each local board verified. One truck was used for each company.

The company was marched in single file by the supply house on its way into camp. Each man was given a bundle which had been previously prepared, containing one mess kit complete, toilet articles, slicker, and blankets. In front of headquarters another check was made, and the induction papers, sent from each local board with the recruit designated as captain, were taken along, with any report the captain had to make. The company fell out, each man securing his baggage from the pile belonging to his company, fell in again, and marched to its company street. The men were then taken to their mess hall, to find a hot meal awaiting them regardless of the time of arrival. The company was later reformed, alphabetically, by local boards, at the headquarters office. The recruit's name was verified, compared with its spelling on the induction papers, and lists prepared for each local board group, showing the date of induction, date of joining, and the company to which assigned. Three copies of lists were sent with the induction papers to the physical examining office; one to the company commander for his official roster; one to the supply officer, who at once prepared the individual equipment records; one to the surgeon, for preparation of vaccination records; one to the post office; one retained, from which the index cards were begun. These cards were completed on receipt of the service record following the physical examination of the recruit.

Each recruit was then tagged. On one side of the tag a verse was printed telling what was expected of him as a soldier, the other gave his company number and post-office address. An hour's talk of welcome and general instructions was then given the company by the chaplain and company commander. The company was marched to one of the Young Men's Christian Association buildings, each man furnished with writing material and encouraged to write a letter home. A mimeographed letter prepared by the morale officer and signed by the commanding officer was inclosed, assuring the family of his safe arrival and asking their support.

The company was bathed and that afternoon or the following morning reported for physical examination. The men examined and rejected during the morning were discharged from the draft that same afternoon and sent to the quartermaster for pay and transportation home. Those rejected in the afternoon were discharged the following morning. The men accepted in the morning were clothed and equipped in the afternoon by the supply officer. Those accepted in the afternoon were clothed the following morning. All civilian clothing, handbags, and grips were then packed, tagged, and shipped home by express for the recruit, or otherwise disposed of by him. He was allowed to retain nothing except his uniform clothing and equipment. He now ceased to be a civilian and his military life commenced.

All men were required to keep their hair cut shorter than 2 inches. Hair clippers were furnished each company and practically every man in the company received a free hair cut the afternoon he donned his uniform. The recruit was then ready to begin his training.

Until the replacement group at Camp Greenleaf was organized, to which the recruit was transferred after his quarantine period, to continue his training and be classified and assigned according to his qualifications, men were transferred directly to various medical detachments throughout the country and to overseas replacement units. The recruits longest in camp were transferred first, an attempt being made to transfer whole companies as far as practicable, except the sick and those held for one reason or another. Lists were prepared at the group headquarters office, designating, by companies, the names of men, date, and hour of departure. This office received the individual equipment records from the supply office, the vaccination cards from the surgeon, completed indorsements on service records, pay cards etc., and had, at the time of transfer, all papers ready to be forwarded with the men. The company commanders assembled and reported to headquarters all men ordered transferred. Each man had his personal effects in his barrack bag and the bag was tagged, giving his name and destination. No other baggage was transported. If the men were traveling by train, each was issued a muslin bag in which to carry his mess equipment for use en route. These bags were purchased in lots of 5,000, out of the company fund, having been made up by civilian firms.

As each recruit's name was called from the final transfer roster, he deposited his barrack bag in a waiting truck and fell in line beyond. When all had thus been checked, the detachment moved off. Thus, by standardizing and systematizing the receiving and transfer of recruits, 2,000 men daily could be handled without confusion or error, the whole work being performed in a machinelike manner.

EVACUATION HOSPITAL GROUP

In 1917, the evacuation hospitals and hospital trains were formed in what was known as Battalion No. 14, which designation was later changed to the hospital group.²⁰ Evacuation Hospital No. 3 was the first to be organized. All the personnel, except the commanding officer, was selected by the camp commander and assigned to this unit. Not only was the hospital organized completely, but after organization its personnel was used to conduct a subsidiary course, so as to relieve the regular instruction companies of some of the special instruction. A class of 20 officers was assigned to duty with the evacuation hospital to take the course in the duties of a regimental surgeon. This course lasted about two weeks and covered administrative duties of regimental surgeons and assistant regimental surgeons. The work in the above class was so arranged that the student officers attended lectures and quizzes of the basic course at the medical officers' training camp.

School for enlisted men, privates first class, and privates, Evacuation Hospital No. 3, consisted of daily lectures by officers of the evacuation hospital, on duties of soldiers, Medical Department.¹⁹ These lectures were followed by a quiz, conducted by squad leaders. In addition to this, the enlisted men were divided into groups of from 12 to 15 men each, and one officer-instructor was assigned to each group. The work outlined in Mason's Handbook was completely covered in detail by lecture and quiz by these officer-instructors, and special work peculiar to evacuation hospitals was given. All enlisted men of

this command were required to take this course; approximately 90 privates first class and privates completed the course of instruction and were sent out as regimental detachments. About 12 of such detachments were formed, using these men as the nucleus for the enlisted personnel.

Later, Evacuation Hospitals Nos. 4, 5, 6, and 8 were organized, but these units had the entire officer personnel assigned to them by orders from Washington.²⁰ The officers of these units received thorough general instruction, and a number of the enlisted men received instruction at the post hospital in addition to the regular military training given at camp.⁵⁴

During the early part of 1918, the demand for the rapid organization of base and evacuation hospitals was so pressing and the shortage of men was so acute that the commandant wrote the following letter:⁵⁵

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., April 8, 1918.

From: The Commandant.

To: The Surgeon General of the Army, Washington, D. C.

(Attention Colonel Munson).

Subject: Base and evacuation hospitals.

These base and evacuation hospitals are being organized as rapidly as time and personnel will permit. However, at the present time there are about 1,200 men available for this purpose; these are only available because they have been held intact for this purpose; the result being a shortage of about 800 men to fill assignments in other camps, with new orders coming in daily.

2. It is obvious that this camp can not meet the demands for organization and replacement troops and send detachments to the various home stations, when there is a present shortage here of something over 6,000 men.

3. The rapidity with which the last draft quota is being ordered from this camp (especially calls for N. C. O.'s), the correspondence from different divisions as to forming new units, the reservations by the specialists in the Surgeon General's Office, and the demands for officers for general service show an apparent lack of coordination between the officers directing the income and outgo of this camp in the matter of personnel which results in demands that are manifestly impossible under the present allowance as to time and men.

4. Attention is also invited to the fact that a considerable number of the drafted men are afflicted with venereal disease, hernia, and other disabilities that are acceptable under existing selective service regulations, but are not available for transfer according to instructions from The Adjutant General. This fact is causing an increasing number of temporary ineligible.

Definite figures on this matter are being compiled.

H. P. BIRMINGHAM, *Colonel, Retired.*

[First indorsement]

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
April 15, 1918.

To the COMMANDANT, M. O. T. C.,

Camp Greenleaf, Fort Oglethorpe, Ga.

1. Returned, inviting attention to confidential letter from this office of April 11, and memorandum to Colonel Munson of April 13.

2. It is desired that, in the absence of sufficient enlisted men to complete the units authorized, at least the skeleton organization be found.

3. It is the intention to request assignment of Sanitary Corps and quartermaster officers to base and evacuation hospitals as soon as they are authorized.

By direction of the Surgeon General:

W. L. HART,
Lieutenant Colonel, Medical Corps.

During this time a number of hospital trains were organized and received training. This training was mostly general in character, for at that time there were no regular hospital trains at camp on which special instruction could be given.⁵⁶

In June, 1918, the shortage of enlisted men at the camp was still so acute as to call forth the following letter and reply thereto.⁵⁷

JUNE 3, 1918.

From: The Commandant.

To: Col. P. M. Ashburn, Surgeon General's Office, Washington, D. C.

Subject: Base and evacuation hospitals.

1. Referring to the following memorandum just received:

1. The overseas section desires that all base and evacuation hospitals now in your camp, that are ordered to other camps or posts, be sent without delay and that the enlisted strength of each be brought up to at least 50 men.

It is required that the same requirements apply to units to be ordered away in the future, unless the orders be for overseas service, when they should be filled to capacity.

2. I have already written you regarding the situation as to base and evacuation hospitals here. We can, of course, take 50 men from the recruits just arrived and not yet in uniform and send them away to the other camps and posts to which they are ordered. They will have no training in basic work, will probably be put directly in the hospitals for training and ward work, and it seems to me the results would not be satisfactory to the hospital division.

3. As I have already written you, these organizations would have long since been created and long since sent away, if the enlisted personnel for them had been provided. The best way out of an unsatisfactory situation would seem to me to have these outfits stay here six weeks and let us fill them up so that they will go away, not with 50 men, but with their full quota, and drilled and disciplined into some semblance of soldiers. We can do this, provided we are not called upon to meet small calls for the United States, which in the aggregate make heavy drains.

As I wrote you the other day, none of the base or evacuation hospitals which are ordered to other camps and posts, outside the ones that are held complete and intact, and which are already trained, other than Base Hospital No. 47, which is recruiting up, can be filled up with men with more than a week's service. It would seem to me very unsatisfactory to send them out under such conditions. I believe their training here for six weeks should be considered as indispensable.

Will you please take the matter up with the hospital division and let me know what their decision is in the matter.

E. L. MUNSON,

Colonel, M. C., United States Army.

JUNE 8, 1918.

From: Col. P. M. Ashburn, M. C.

To: Commandant, M. O. T. C., Camp Greenleaf, Fort Oglethorpe, Ga.

Subject: Base and evacuation hospitals.

1. Referring to your letter of June 3, on the above subject, I have tried to obtain a conference in regard to it with General Noble, but thus far unsuccessfully. I therefore referred the letter to the hospital division for comment, and it is to-day back with the following memorandum signed by Lieutenant Colonel Hart.

JUNE 7, 1918.

Memorandum for Colonel Ashburn:

With reference to attached letter, we desire that the units which have been or may hereafter be ordered organized in medical officers' training camps, and which are ordered without delay, and that the enlisted strength of each be brought up to at least 50 men. The nearer the unit can be brought up to its normal enlisted strength the better, but the compliance with the order should not be delayed to this end: At least 50 men should be assigned to the organization under any condition.

This does not apply to those ordered from camp for overseas service, in which event the unit should be brought up to its full capacity.

W. L. HART,

Lieutenant Colonel, Medical Corps.

One inclosure.

* * * * *

3. In further conversation, Lieutenant Colonel Hart tells me that the units now ordered away and to go over in the third phase, should have gone to various camps on April 16, and that they must now get hospital training whether they have any other or not.

* * * * * *

By direction of the Surgeon General:

P. M. ASHBURN, *Colonel, Medical Corps.*

During July, 1918, the organization of evacuation hospitals became exclusively a part of the general program of Camp Greenleaf.⁵⁸ The plan contemplated producing, by intensive drill and instruction in various professional and special schools, a more or less adequate supply of standardized commissioned and noncommissioned personnel for use in making up standard units in the shortest possible time. In accordance with this plan, a group was created for the organization of evacuation hospitals. This was known as the evacuation hospital group. Its personnel was composed entirely of temporary officers and men. Its administrative machinery consisted of a headquarters, a headquarters company, and 12 hospital cadres. The headquarters officers and personnel were about such as would obtain in a regimental organization. The hospital cadres were about such as would obtain in the cadre-company organizations of a recruit depot—that is, 3 commissioned and 24 to 36 non-commissioned officers each. Their functions, likewise, were analogous to those of recruit depot companies. These cadre men were especially selected for their aptitude and qualifications in company administration, clerical work, property handling, mess management, drilling, and instructing.

The organization of a given hospital was initiated by the assignment of a contingent of recruits to a hospital cadre. The drill and instruction scheduled and carried out were designed with the chief aim of producing hospital commands of men of high grade, physical fitness, discipline, and morale.⁵⁹ By repeated physical and mental surveys, the unfit were discovered and eliminated, the fit reclassified and improved. Instruction in the duties of a soldier was given by members of the hospital cadres—by precept, lecture talks, and demonstrations.

Instruction in hospital administration, including all paper work, and in nursing and ward management was given by cadre officers and men and by chiefs of hospital services in lecture talks and demonstrations. Drill methods of both Infantry and Medical Department were used, Infantry foot drill being used for the greater portion of the time. The importance of drill in achieving discipline was emphasized, and the routine schedule was made as elaborate and thorough as possible. Fully one-half of each duty day was profitably taken up with drill formations, interspersed with short periods of instruction. For the purpose of promoting efficiency in administration and the handling of men, the camp command was organized after the manner of a regiment—into battalions—and hospital officers were rotated in the offices of company, battalion, and regimental commanders.⁵⁸

The outstanding importance of morale was emphasized, and morale was promoted by a judicious mixing of work and recreation; by a headquarters morale office; by a somewhat extravagant outlay for outdoor entertainments—theatrical, athletic, and social; and by a constantly preached, practiced, and enforced policy of unit independence, originality, and self-sufficiency. The group's motto was "Like your job." ⁵⁸

Technical training at the camp was not undertaken except as above mentioned—through lectures and elementary demonstrations—but the practice of sending completed hospital units to base, camp, or general hospitals, where they were temporarily attached for duty prior to departure for overseas, served the purpose.

The actual time consumed in organizing standard evacuation hospital units was about two months; that is, the camp could, and did, produce 12 evacuation hospital organizations every two months; or, from July, 1918, to November, 1918, it produced Hospitals No. 25 to No. 49, inclusive.⁵⁸ In forming so many units of this character it was considered of great importance that the instruction should be standardized so as to be able to give as much instruction as possible in a short time. To accomplish this the following group order was issued:⁵⁹

General Orders, No. 1.

HEADQUARTERS EVACUATION HOSPITAL GROUP,
Camp Greenleaf, Ga., July 24, 1918.

* * * * * *

1. The evacuation hospitals and hospital trains in this camp constitute the units of this group. The staff of the commanding officer will consist of an adjutant, a personnel adjutant, a supply officer, a mess officer, and a sanitary inspector. There will be a headquarters company. The adjutant, the personnel officer, and the commanding officer, headquarters company, have been designated. The evacuation hospitals will constitute a section and the hospital trains another, each with a field officer or the senior officer on duty therewith as section commander.

2. In view of the limited periods of time that members, both commissioned and enlisted, of any units have or in all probability will remain on duty here, it will be the policy of this command, in so far as practicable, to aim at standardization in all matters pertaining to administration, drill, and instruction.

3. *Standardization of drill methods.*—In order that drill methods in practice among various units may be further perfected and standardized, one drill period daily will be taken up by section commanders in drilling the officers of their units. The period selected will be that now given over to physical drill, and the drill subject or movements for each day will be those to be carried out later on the same day at company drill. The efficiency of unit drill methods will be perfected by drill and instruction of drillmasters, subalterns, and N. C. O's., to be given in the case of each organization by the unit commander.

4. *Standardization of instruction.*—What has just been said relative to drill methods will apply in the case of instruction methods. It is desired that schedules, (1) for officers, (2) for men, be made for use throughout and be based upon a study of what is considered most essential that can be covered in the limited period of time, that is, three weeks. In preparing these schedules, it will be necessary to take into consideration not only the limited time available, but the fact that all the members are raw and inexperienced, and that the prime purpose of their training is to fit them for service in the units to which they belong.

5. *Standardization of administrative methods.*—It is desired that section commanders make a study of company administration so that uniform methods may be in practice in company offices (records, messes, property handling, police, care of barracks, grounds, etc.). Orders will be issued shortly prescribing the method to be followed in organizing units.

6. The sanitary inspector will submit a study recommending methods to be followed in physical and sanitary instruction and other hygiene measures.

By order of Colonel Rutherford:

W. W. HOYT, *Captain, M. R. C., Adjutant.*

The instruction for the officers and men of this group was outlined in specially prepared schedules, as follows: ^{60 61}

Evacuation hospital group, Camp Greenleaf, Ga.—Schedule of instruction for enlisted men, first week, beginning July 29, 1918

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 a. m.	7 a. m.	7 a. m.	7 a. m.	7 a. m.	7 a. m.
Policing	Policing	Policing	Policing	Policing	Policing
7.45	7.45	7.45	7.45	7.45	7.45
Setting-up exercises	Setting-up exercises	Setting-up exercises	Setting-up exercises	Setting-up exercises	Setting-up exercises
8.30	8.30	8.30	8.30	8.30	9
Drill school of the soldier	Drill school of the soldier	Drill school of the squad	Drill school of the squad	Drill school of the company	Inspection on field
10.30	10.30	10.30	10.30	10.30	10
Instruction, personal hygiene and sanitation	Instruction, first-aid packets	Instruction, care of the feet	Instruction, bandaging	Instruction, uses of tourniquets	Inspection, quarters
11.30	11.30	11.30	11.30	11.30	
Recall	Recall	Recall	Recall	Recall	
1.30 p. m.	1.30 p. m.	1.30 p. m.	1.30 p. m.	1.30 p. m.	
Practice march and games	Practice march and games	Practice march and games	Practice march and games	Practice march and games	
4.30	4.30	4.30	4.30	4.30	
Recall	Recall	Recall	Recall	Recall	
5	5	5	5	5	
Retreat	Retreat	Retreat	Retreat	Retreat	

By order of Colonel Rutherford:

W. W. HOYT, *Captain, M. R. C., Adjutant.*

Evacuation hospital group, Camp Greenleaf, Ga.—Schedule of instruction for officers first week, beginning July 29, 1918

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7 a. m.	7 a. m.	7 a. m.	7 a. m.	7 a. m.	7 a. m.
Section conference	Section conference	Section conference	Section conference	Section conference	Section conference
7.45	7.45	7.45	7.45	7.45	
Drill	Drill	Drill	Drill	Drill	
1 p. m.	1 p. m.	1 p. m.	1 p. m.	1 p. m.	
Group conference	Group conference	Group conference	Group conference	Group conference	
2	2	2	2	2	
Lecture: "Organization and function of evacuation hospitals," by Colonel Rutherford	Lecture: "Office management" by Captain Hoyt	Lecture: "S. and W. cards," by Major Percy	Lecture: "Property accountability and responsibility," by Captain Essertier	Lecture: "Organization and function of hospital trains," by Major Paul	

By order of Colonel Rutherford:

W. W. HOYT, *Captain, M. R. C., Adjutant.*

The following evacuation hospitals were organized at Camp Greenleaf: Nos. 3, 4, 5, 6, 8, 13, 14, 22, 23, 24, 25, 26, 27, 28, 30, 31, 32, 33, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53.²¹

Evacuation Hospitals No. 25 to No. 53, inclusive, were organized in the specially constituted evacuation hospital group.⁵⁸

NONCOMMISSIONED OFFICERS' GROUP

When the camp was first organized each small unit or group trained its own noncommissioned officers.¹⁹ These small schools existed in Battalion No. 14 (hospital group), Battalion No. 15 (recruit camp), field hospital group, and ambulance company group.⁵⁴

The course of instruction in these small schools averaged seven weeks, and the output was sufficient for the needs of the then small camp.

As the camp became larger a distinct noncommissioned officers' school was organized in Battalion No. 15 and a small group, known as the noncommissioned officers' school group, was formed. In this group was not only the noncommissioned officers' school, but the sanitary squads, convalescent camps, convalescent depots, mobile operating units, and cooks' school.⁶²

The curriculum for the noncommissioned officers' school was arranged to cover as completely as possible the military duties of noncommissioned officers of the Medical Department, requirements of paper work necessary in all sanitary detachments, and the handling of men; the object being to have on hand and to supply on demand well-trained personnel ready for promotion to corporals and sergeants.⁶³ It had been worked out so that any number of officers might be sent to this school and trained for the specific duties of various units, such as convalescent camps, their training being in part separate from and in part conjointly with the men who were to become their enlisted personnel.

After such units had been designated to be trained here and their enlisted men selected, they were advanced to this specific training, the remaining men attending the regular school duties until they were designated for special organizations.

The regular curriculum of the school consisted of 24 hours per week of didactic lectures on paper work, selected portions of Army Regulations and the Manual for the Medical Department, and the solution of practical problems; 7 hours per week on Mason's Handbook and Sanitation, and several hours' instruction each day in the school of the soldier, platoon, and detachment, litter and shelter-tent drill.⁶³

At that time, even though a special school was organized, each of the larger groups continued to have schools for noncommissioned officers.³⁶

The regular noncommissioned officers' school continued steadily under this plan up to late spring of 1918, as is shown by the May report of the school: ⁶⁴

On May 1, the total strength, enlisted personnel, of this command was 206. Seventy-five of this number, including 21 sergeants, 24 corporals, and 16 cooks, as the headquarters detachment of this command, were the permanent detail for the internal administration of all the units of Battalion 15. The balance (131) were enrolled in the school proper.

The regular course of didactic lectures, practical work on papers, and drills was carried out, and during the month 67 of these 131 men qualified for promotion, warrants being given to 52 as sergeants and 15 as corporals.

At the end of this school period there remained 64 men, about half of whom would have qualified for warrants after about a week's further instruction. These men were sent out to fill orders as having the qualifications for prospective noncommissioned officers. About 30 of the 64 men who were not recommended for warrants were sent out to fill orders as privates, they having shown no qualifications to support the belief that they would at any time rise above their present status.

During the month there was concluded a two weeks' special course on venereal prophylaxis, to a few selected men from this school. These men are now being held to fill orders in furtherance of this work. That is, to go out among different camps as missionaries in the prevention of venereal diseases.

At the end of the month the headquarters detachment for the administration of the units of Battalion 15 was intact. The enlisted personnel of the school proper consisted of 6 privates and 1 sergeant.

A special noncommissioned officers' group was formed in July, 1918.⁶⁵ The personnel was at first recruited from the better elements of the various groups of the camp. After these early days, however, the men were selected upon their arrival at the replacement group after an initial two weeks training in the detention group. Thus it will be noted that noncommissioned officers were created from absolutely green material, with a very short period of instruction. All candidates before being sent to the noncommissioned officers' group were passed upon by a board of officers who considered the following qualifications: Education, practical training, recommendation of immediate commander, personality, and psychological rating. Candidates were received in groups, several hundred in number, at intervals of approximately two weeks. The school grouped each draft into a battalion, composed of 4 companies and numbering about 400 men. The entire school consisted of 3 battalions, as a rule, of approximately 1,200 men. The number grew steadily with the increase in size of the camp, and had not the armistice cut short this work, this school would soon have enrolled 3,000 picked young men.

The course was of six weeks' duration.⁶⁵ The first day was consumed in facilitating the adjustment of the candidates to their new surroundings, and in the selection of acting noncommissioned officers from among their number to fill the majority of the company details. Each company was commanded by a commissioned officer, who was assisted by a first sergeant and a duty sergeant of the permanent cadre of the noncommissioned officers' group. Companies were made as nearly self-supporting as possible from the first day. The men in training got out all the required daily, special, and routine reports, thus familiarizing themselves with the ordinary company reports. They formed the platoons, assembled the company, and acted as squad leaders. They were detailed in turn as acting mess sergeants. Details were changed by roster, so that before graduation each man had served through all the company grades.⁶⁵ Individual performance was closely scrutinized and daily rating kept by the company commander so that most company commanders by the time of the conclusion of the course were able to appraise their men very justly. Each day opened with first call, at 5.20 a. m., and formally closed with retreat at 4.30 p. m. It was very rare that men were granted or requested a pass. Occasional exceptions were made to this rule when an entire battalion or the entire command were given passes as a reward for unusually good general showing. Special classes were frequently held in the evening.

Efforts were centered on making direct appeals to the individual.⁶⁵ Each man wore his name in large print on a white muslin strip over the pocket on the left side of his shirt, as was done in some of the officers' training camps. Each man knew he was being watched, not only by his company commander and other commissioned officers, but by noncommissioned officers, and by those of more concern to him than all others, his comrades. A typical cadet spirit was soon developed. The companies were formed at reveille and kept at work all day. They first completed a brisk general police of camp, then policed their tents, and attended to personal hygiene. The companies were next formed and double-timed to breakfast, one-quarter mile. This formation was repeated on return from breakfast in order to bring the men together with a snap early in the day. A short respite was then allowed. The companies were double-timed to drill field at 7.30 a. m. At the conclusion of drill at 9 a. m. they were returned in the same way, except that intervals were scheduled between battalions in order that all men could be given time to bathe. This saved time, freshened the men after the morning's physical stress, and put them in a receptive mood for class work, which followed immediately thereafter, in two 50-minute periods. The afternoon afforded two more 50-minute periods for class work, and at 3.30 the battalions were again on their way to the drill field, where they remained until 4.30 p. m. Twice weekly during this hour the entire command was formally paraded. Class work was made as practical as possible, much time being given to interrogation and preparation of forms, which, when handed in, were corrected and returned.

During the month of October, 1917, a change in the system of obtaining instructors for the school was inaugurated.⁶⁶ The basis of the entire scheme was practical instruction, to be carried on in groups of not more than 10 men, preferably 5. In order to carry this out, it was necessary to obtain a large force of men who were competent to teach. Medical officers in such numbers were not available. It was then decided to use the graduates of the school for adjutants, registrars, and mess officers for this purpose.⁶⁶

The school for adjutants, registrars, and mess officers, which was a part of the noncommissioned officers' group, trained men for commissions in the Sanitary Corps.⁶⁶ Its course consisted of two parts—first, four weeks of didactic teaching entirely similar to the course in this school; second, at the end of that time those who had qualified were given a subsequent course of practical instruction of at least four weeks. If then it was found that suitable progress had been made, these men appeared before a special board for examination for commission in the Sanitary Corps.

The majority of the men coming from that school were of the grade of sergeant, or higher.⁶⁶ It was thought that this practical instruction could be given these men in necessary paper work, handling of men, mess management, etc. To this end, these men were assigned as cadet officers to the various companies of the school. In this manner they handled the companies as actual commanding officers, getting practical instruction in organization, the handling of men, all the necessary paper work, and mess management, and at the same time they were used as instructors in the various branches taught in the school. Two purposes were thus accomplished—first, the candidates for commission

received the practical instruction required, and, second, the knowledge these men possessed along special lines was made of use. By using these men, the instruction was divided into small groups with far better results. The amount of work done in the group can be seen by the following table of results covering the period from the inception of the group, July 29, 1918, to October 31, 1918:⁶⁷

	Losses	Per cent
Assigned and joined.....	1,812	
Transferred (recommended for warrants).....	817	62.9
Transferred (not recommended for warrants).....	465	35.89
Died of disease.....	10	.77
Discharged.....	6	.46
Total losses.....	1,298	
Remaining.....	514	
Total.....	1,812	

MORALE DEPARTMENT

On March 2, 1918, a memorandum was submitted to the Surgeon General by the commandant, Camp Greenleaf, outlining rather definite methods for the establishment and maintenance of soldier morale.⁶⁸ In May the commandant made practical application, in the camp, of the proposed plan. On June 6 a camp morale officer was appointed, with duties as outlined.⁶⁹

General Orders, No. 57.

HEADQUARTERS CAMP GREENLEAF, *Chickamauga Park, Ga., June 6, 1918.*

1. The position of morale officer for Camp Greenleaf is hereby created.
2. The duties of the morale officer relate to the psychological uplift of recruits and the early development of a wholesale mental attitude by them toward service in the Army and in the Medical Department. They are especially intended to make the introduction of the recruit into the service as pleasant and instructive an experience as is practicable with due consideration for military requirements.
3. The morale officer will take measures for the provision and operation throughout the camp of an effective organization for the early information of recruits in respect to their personal relation to the military service; the sympathetic understanding of their personal difficulties and of advising therein; the stimulation of patriotism, and inculcation of loyalty to superiors; the allaying of suspicion toward, or opposition against, the military service; the provision of suitable recreation and education; the fostering of ideals of equity and sportsmanship; and the promotion of the spirit of service.
4. To this end he will coordinate and systematize all existing agencies and methods calculated to facilitate the adjustment of the recruit to the military environment, and take such additional measures, not interfering with military duties, as may seem desirable for the purpose.
5. The morale officer will have such representatives and assistants, throughout the various sections and organizations of Camp Greenleaf, as may be necessary.
6. Full advantage will be taken of the services in this respect of the chaplains on duty at Camp Greenleaf.

The personnel and facilities of the Young Men's Christian Association, Knights of Columbus, Jewish Board of Welfare Workers, and committee on training camp activities will be utilized to the full extent offered for the purpose by those organizations.

By order of Colonel Munson:

W. S. SLEDGE, *Major, M. R. C., Adjutant.*

On June 13, in response to a request from the commandant, a memorandum was submitted to him by the department of military psychology, suggesting a detailed program for improving the morale of recruits. These suggestions were criticized and returned, and a revised program was submitted by the newly appointed morale officer.⁷⁰

The revised plan as approved and returned to the camp morale officer was put into effect in the 15th Battalion, detention camp, Camp Greenleaf, on June 20.⁷¹ A large tent was erected opposite battalion headquarters, near the Young Men's Christian Association Building, and central with respect to the arrival and departure of troops. The assistant morale officer, with a detachment of 35 enlisted men from the school of military psychology, was detailed to initiate this work. The purpose of the commandant was so to standardize a method in this battalion that it could be made applicable to other sections of this camp, and also be offered to the General Staff as a tested program for the institution of similar organizations in other camps throughout the country.⁷⁰

The personnel for this work was distributed as follows:⁷¹

In each detention camp (2,000 to 5,000 men):

One morale officer.—In general charge of work in camp. In particular, confers with Young Men's Christian Association and other workers, chaplains, and morale soldiers each day, to arrange program in detail for following day. Program distributed to companies for posting on company bulletin boards. Receives from each morale soldier a formal report of activities during previous 24 hours. Makes daily consolidated report to morale officer, with copies to each company commander and to each section commander.

One chaplain and assistant.—General oversight of religious instruction, instruction in English branches, formal inspirational talks, and mail, for the first three of which he is responsible with respect to program followed. Talks to men upon arrival and departure.

One civilian worker.—Cooperates with chaplain on religious instruction and formal talks.

One civilian worker.—Cooperates with chaplain in English instruction. Furnishes instructors, arranges program of intensive detail. Instructs at least one hour per day.

One civilian worker.—Arranges with company athletic officer with regard to athletics and games. Arranges program within each company during week, and between companies Saturday and Sunday.

One civilian worker.—In charge of entertainments; responsible for entertainments to be held every night.

Two civilian workers.—Assists in above, and in singing.

One training camp activities officer.—In charge of group singing. Responsible for group singing in camp two nights per week. General oversight of singing in smaller groups.

Two morale soldiers.—In charge of information booth.

One morale soldier for each company.—To act as sick sergeant. Leads in company group singing on all possible occasions. Assists in drill. Gets into touch close with men. Makes formal daily report to morale officer, especially with regards to suggestions for the improvement of morale in the company. Responsible for letter home. Either assists in athletics or aids as instructor in English.

Approximately seven weeks later it was believed by the commandant that the system already instituted in the 15th Battalion had become sufficiently standardized to permit of its extension to other sections of the camp. This extension was accordingly ordered and effected, as outlined below:⁷⁰

INTENSIVE MORALE PROGRAM AS APPLIED TO RECRUITS

The morale work is broadly divided into an intensive and extensive phase. The intensive phase is concerned primarily with the stimulation of the morale of the recruit from the time he detains until he leaves the detention camp—a period normally of two weeks. The extensive phase of the work concerns itself not only with the recruit during his stay in the detention camp, but equally to the later developmental periods of his training.

A. *Detrainment*.—The troop trains are met by officers and noncommissioned officers, the latter including one noncommissioned officer especially detailed for morale duty with each company, who assemble the men by local boards and march them to the detention camp. They are encouraged to sing and cheer on the march.

B. *Upon arrival at camp* the men are assigned to companies and taken to the company streets, where the morale sergeant assists them in their primary adjustments. They are shown how to make their beds, instructed in the use of mess kits and the saving of water, and are informed as to the location of company mess halls, latrines, and wash houses. They are given an unusually good first mess and a bath. Instruction is attempted by friendly counsel rather than by the depressing method of trial and error.

C. *Primary morale system*.—(1) Upon the morning of the recruits' first full day in camp they are rostered by companies, after which they are turned over to the morale sergeant of their company and marched to the information tent, which serves as the headquarters of morale work in the detention camp. Here they are given a tag, bearing on one side the following paragraph:

You are now a Soldier of the United States; a Soldier Selected by your Country to fight for the Freedom of the World.

WALK like a soldier

THINK like a soldier

ACT like a soldier

BE A SOLDIER!

This is not easy to do at first and there may be things that you do not understand. Never mind; all good soldiers have learned to do the same things that you are learning to do. Remember you follow a flag that has never led in an unjust war. Remember that the American Army has never yet been defeated. Do your part now and it never can be. Keep your head up, your eyes open, and smile!

On the reverse side of this tag is stamped the recruits' new company and camp address, with a blank space for autograph, which is written in at this time, and the tag is then firmly attached to the clothing. This tag serves, during the first few days, the double purpose of identification and inspiration.

(2) The recruits are now marched in company formation, still under the direction of the morale sergeant, to some open-air amphitheater, or to an auditorium if the weather be inclement, where they each receive a copy of the pamphlet *Keeping Fit to Fight*, issued by the social hygiene division of the Commission on Training Camp Activities, and given an informational talk by the morale officer or his representative. This talk, which is, of course, informal, nevertheless attempts to cover briefly the following points:

I. Nature of detention camp.

1. Boundaries.
2. Relation to permanent organization.
3. Reasons for detention—
 - (a) Assurance against introduction of contagious diseases.
 - (b) Preventives—
 - Vaccination.
 - Inoculation.
 - Hookworm.

II. Venereal Diseases and related Army Regulations.

III. Entertainments and athletics:

1. Programs for detention camp.
2. Entertainers report for entertainment duty.
3. Daily detailed athletic period.
4. American Library Association—library privileges.

IV. Informational system:

1. Tent and headquarters.
2. "Sick sergeant"—company information bureau.

V. Letter-writing:

1. Detailed opportunity.
2. Inclosure (form letter signed by battalion commander).

VI. Clothing—reasonable attitude toward fit.

VII. Food—wholesome not dainty.

VIII. Military qualities of a soldier—discipline.

IX. General qualities of a soldier—manliness, cheerfulness, indifference to hardship, etc.

(3) The recruits are then taught a lively Army song by a morale song leader, and are given a brief inspirational talk by the chaplain or his representative, covering such important points as:

- (a) Words of welcome and encouragement.
- (b) Character of Army discipline and necessity for absolute obedience.
- (c) Friendly attitude of officers.
- (d) Aims of the war.
- (e) Character of the enemy.
- (f) Moral problems of the soldier.
- (g) Danger of giving way to homesickness.
- (h) Seriousness of going A. W. O. L.
- (i) Personal relations of chaplain and soldier.

(4) This program, from the time the recruits are marched to the information tent until the conclusion of the chaplain's talk, consumes approximately 45 minutes and sends the men to their company streets with some clearer ideas of what we are fighting for and what soldier discipline means; of what their immediate future training involves, and with something, too, of the spirit of the camp imparted to them.

(5) Either immediately following the program just outlined, or in any event within the first 24 hours, the recruits are detailed to the Young Men's Christian Association Building, or to some other suitable place, to write and mail a letter home. In this communication they were required to inclose the following letter, giving their address and signed by the battalion commander:

CAMP GREENLEAF,

Fort Oglethorpe, Ga.,-----

----- has safely arrived at this camp. (Date) He will remain here for some time, getting used to Army life, and learning the first simple things that our soldiers must know.

The Army supplies him with clothing, shoes, good food, comfortable quarters, and medical attendance. But in another way your help is needed. Give him the support of your confidence and cheer.

Write to him often! Getting mail is a big event in a soldier's day, and getting none is a real disappointment. If pleasant things happen at home, write him about them. If you are proud of him, tell him so. *Let him know that you are back of him.*

Don't be worried if your first letters to him are delayed; that is bound to happen sometimes. Keep writing just the same, and we will see that he gets all you write, even if it takes a little time.

Remember always that you, too, are a part of the American Army—you are the army of encouragement and enthusiasm. Write letters filled with these things to your soldier, and you will help us to help him.

His address is: Company -----, Battalion 15, Camp Greenleaf, Ga.

N. T. KIRK,

Major, M. C., Battalion Commander.

This letter also serves a double purpose: That of promptly informing the people at home of the safe arrival of the soldier at his new address, and that of enlisting civilian support. The replies to these letters received by the battalion commander indicate their value as a stimulus of both civilian and soldier morale.

D. *Personal attention.*—In each company, as previously indicated, there is a representative of the morale organization, known as the sick sergeant, who performs, among

other tasks, the duties of that office. In addition, this soldier serves as a source of general information, visiting the tents, giving short informational talks, disseminating notices and programs, leading in mass athletics and company singing, acting as noncommissioned officer in charge of mail, and in general serving in such other less specific ways as may contribute to the upbuilding of soldier morale. He reaches men not only at sick call, but during rest periods in drill and in the evening. He stimulates group athletics, the organization of teams, and intercompany games. He supplies the company bulletin boards with programs, cartoons, illustrations, and other literature of morale value.

E. Group entertainments.—Entertainment programs lasting for from two to two and a half hours each evening are provided at the open air theater or in the huts and tents of the Young Men's Christian Association, Knights of Columbus, and Jewish Welfare Board, several entertainments sometimes running simultaneously in the same section of the camp. These entertainments comprise vaudeville, boxing, wrestling, band and orchestra concerts, mass singing, motion pictures, war talks, inspirational addresses, and dramatics.

The talent for these programs is generally selected from among the soldiers themselves. The morale sergeant in each company is constantly and systematically on the alert to discover musical or other entertaining ability. Entertainers so discovered are given try-outs, and those of professional excellence serve throughout the camp.

F. Information tent service.—Each of the six sections into which the medical camp is divided possesses a headquarters tent or building. The original information tent in the detention camp is typical; here there is a desk for the section morale officer, his first sergeant, and the morale song leader. There are also desks at this headquarters, or adjacent thereto, for the section entertainment officer, the section athletic officer, the chaplain, and a representative of the Red Cross Society, together with such stenographers and orderlies as might be necessary for effective paper work. Near this headquarters is located a section bulletin board (to which further reference will be made).

There is a daily meeting of morale sergeants with their section morale officer at a stated time for the discussion of problems and the submission by each sergeant of a daily written report of activities in his respective company, with such suggestions for the improvement of company morale as may from time to time appear desirable. At these meetings, athletic schedules are arranged, companies are matched in volley ball, baseball, and the like, and conflicting schedules are adjusted.

G. Upon transfer of men from the detention camp to other sections of Camp Greenleaf, they receive a brief farewell talk by the chaplain or by his representative, and are frequently led for a few minutes in singing and cheering.

EXTENSIVE MORALE WORK—ORGANIZATION

A. Headquarters.—The headquarters of the camp morale officer are located in the psychology building. These headquarters serve as an office for the camp morale officer and his immediate assistants, including the publicity and entertainment directors, and in addition provide a desk for the Army song leader and the Army dramatic director. The headquarters of the athletic director, chaplains' association, Red Cross, Young Men's Christian Association, Young Women's Christian Association, Knights of Columbus, Board of Jewish Welfare Workers, and American Library Association are easily accessible. The office of the War Camp Community Service in the near-by city of Chattanooga, through which all civilian entertainments clear, is in daily communication with this office.

B. Coordination and direction of morale work.—In addition to the intensive work above described, the camp morale officer coordinates and directs all agencies directly or indirectly influencing the morale of soldiers. Chief among such agencies in this camp are the Commission on Training Camp Activities, represented directly by the Army song leader, the Army dramatic director, and the social hygiene division, and indirectly by the Young Men's Christian Association, the Young Women's Christian Association, the Knights of Columbus, the Board of Jewish Welfare Workers, the American Library Association, and the War Camps Community Service.

The coordination of these various activities is accomplished by means of frequent conferences of their representatives with the camp morale officer and by weekly reports which are submitted either to the section morale officer or directly to the camp morale officer. These

reports in turn serve as a partial basis for a general weekly report, covering all phases of morale work, submitted by the camp morale officer to the commandant. These agencies submit schedules and programs weekly in advance to the camp morale officer, in order that camp activities may be systematically directed by his office. These activities are then included in the complete weekly program for the entire camp which is submitted to the commandant and is published in advance in the camp and city newspapers. All of these organizations are offering heartiest cooperation and assistance of a very material and practical sort, making possible the outlining of coordinated and nonconflicting programs throughout Camp Greenleaf.

C. Critical and corrective aspects of morale work.—(1) The civilian relief department of the Red Cross investigates and ameliorates unfavorable conditions discovered through morale agencies in the home life of the soldier.

(2) Investigations are made and reports submitted, either to company commanders, to section commanders, or to the commandant, upon canteen service, unsatisfactory mess, unfavorable conditions, easily avoidable, among guardhouse prisoners, unsanitary latrines, poor washing facilities, overharsh or indifferent treatment of soldiers by noncommissioned officers, and in general all those minor but persistent depressants that unavoidably occur from time to time in any company.

D. Material and equipment.—On the material side, tents, labor, and office supplies are furnished through the military; a monthly allowance of \$250 is granted morale headquarters from the canteen fund for general morale purposes other than athletics and set entertainments, which are financed by separate funds. Lumber, moving-picture machines, song sheets, some athletic equipment, musical instruments, and the like, are from time to time generously furnished by the Young Men's Christian Association and by the Red Cross. Minor athletic equipment is obtained through company funds.

E. Miscellaneous.—For special purposes, such as the Liberty loan drive, the morale organization serves as a convenient agent.

EXTENSIVE MORALE WORK—IN THE FIELD

A. Staff.—(1) The camp morale headquarters staff comprises the following personnel: Morale officer; his assistant; directors, respectively, of entertainments, athletics, music, dramatics, and publicity; two stenographers; a side-car driver; and an orderly. At this central office is held the weekly meeting of the morale officers of each section, who meet for conference. An athletic officer and representative from the chaplains' association, the Red Cross, and other civilian agencies are free to attend these meetings and usually do so.

(2) To these central offices come the weekly reports of the section morale officer and the various departments working under him; requests for music, entertainment, and athletic games; and requests through the office of the War Camps Community Service, as well as offers of entertainment from the citizens of Chattanooga. In this way, the various sections of the park are kept in mutual close relations, and the camp as a whole related to the city of Chattanooga.

(3) Each section of the camp has a morale organization of its own, as has been indicated, based upon that originally established in the detention camp, with such modification of staff and method as its own peculiar conditions make desirable. In general, this section morale organization, while, of course, directly responsible in military matters to the section commander, is otherwise responsible to the camp morale officer, who is in turn directly responsible to the commandant. Thus an organization exists for the speedy and effective accomplishment of such morale purposes as the commandant may from time to time suggest; and, on the other hand, unfavorable conditions difficult to remedy through the often overcrowded military channels can, by this means, be promptly ameliorated. A similar table or organization could be devised for a divisional camp, in lieu of that which was in force at Camp Greenleaf, where the medical units effect a rather unusual unit grouping. Such a section unit of this camp includes from 2,000 to 8,000 men.

B. Entertainment.—The entertainers of professional excellence, discovered and selected by the entertainment directors, as previously described, are segregated in a special entertainment company adjacent to the camp morale office, that their services for rehearsals and entertainment may be readily requisitioned. Transportation for these entertainers is

furnished on schedule as submitted to the transportation department. These entertainers at present approximately 75 in number, perform regular company duties until 1 o'clock, when their time is placed at the disposal of the dramatic and song directors for rehearsal and entertainment. All entertainment throughout the camp is requisitioned upon printed forms at least a week in advance, and programs covering these entertainments are similarly scheduled in advance as previously indicated. In addition, a report is made by the section morale officer or his representative upon the morning following any regularly staged entertainment, giving criticisms and suggestions for its improvement. Card indices are kept of all talent and bookings, so that ineffective entertainers may be weeded out and their places filling by incoming material of higher grade. These records are also kept in order to avoid overworking certain men at the expense of others. No man is held in the company longer than three months, and any man may be sent back to regular duty at any time upon recommendation of the camp morale officer. It is the present intention to group these entertainers from time to time, to be sent overseas as integral parts of base hospital units. In addition to entertainment furnished by the "Barnstormers" (professional entertainment company), section morale officers, the Young Men's Christian Association and the Knights of Columbus provide entertainment furnished by local talent. Motion pictures are supplied by the Young Men's Christian Association on a regular schedule to the various airdromes and Young Men's Christian Association buildings, and in addition a number of pictures, secured either by purchase or through the courtesy of film companies, are shown throughout the camp and then returned to the detention camp, where they can be repeated approximately every two weeks to a new group.

Such pictures as "The Unbeliever," "The Crossbearer," and "Keeping Fit to Fight" are illustrations of films permanently kept in the camp and primarily designed for use in the detention camp.

C. Athletics.—(1) Athletic organization:

a. Camp Greenleaf is divided into two tactical units, as follows: Tactical Unit No. 1—Detention camp, Fort Oglethorpe, medical officers' training camp, Section A (under the direction of Athletic Director Dennis W. Sullivan, captain, Medical Corps). Tactical Unit No. 2—Section B, Section C, Section D, Section E (under the direction of Athletic Director J. C. Montgomery, first lieutenant, Medical Corps).

b. Tactical unit directors are responsible to the camp morale officer for the athletic program of the camp (athletic program does not include military physical training; e. g., drill, setting-up exercises, etc.). Reports for each week's activities are submitted to the camp morale officer by Monday 6 p. m. The tactical unit director selects and requests the appointment of an athletic officer for each group under his direction; such athletic officer may be the morale officer for that group himself, where desirable. The tactical unit director exercises supervision over the recreational activities of athletic nature in his unit, and is the deciding authority in case of conflicts within that tactical unit. Intergroup athletics are promoted by the tactical unit director only.

c. Group athletic officers are responsible to their tactical unit director for intragroup recreational athletic organization. Schedules and reports are submitted to the tactical unit director as requested by him. Group athletic officers' work in conjunction with athletic officers of the Young Men's Christian Association, Knights of Columbus, etc., and make the best use possible of available officers and enlisted men in perfecting their group athletic organizations. Group athletic officers further cooperate with entertainment directors in the production of evening entertainment, and submit names of athletic talent with professional qualifications, e. g. boxers, wrestlers, tumblers, etc., to the camp entertainment director, in order that the latter may request the retention of such men in the camp for entertainment purposes.

(2) Athletic games: Regular baseball, volley ball, soccer, and football games are arranged between various units throughout Camp Greenleaf, and during the season a football team will represent the entire camp. Mass games are conducted regularly each day at such times as section commanders may designate. Athletic equipment is supplied by means of funds from the canteen, company funds, and to some extent from the Young Men's Christian Association.

(3) Special athletic features:

a. An outdoor gymnasium has been constructed, the field used for this purpose being approximately 600 feet square. The following apparatus and game courts are located on the field: 8 volley ball courts, 5 indoor baseball diamonds, 1 baseball diamond, 1 cage ball court, 2 basket ball courts, 2 soccer fields, 1 wall scale, 1 trench jump, 1 horizontal bar (for 8 men), 1 set parallel bars (for 8 men), 1 horse (for 8 men).

This equipment makes it possible for this field to accommodate 5,000 at one time. When organized under the supervision of one man, with the assistance of a bugler, most effective use can be made of limited equipment. Every soldier in section B is detailed to this outdoor gymnasium for one hour and a half on three days each week. For the first half hour, calisthenic drills are given to the men, the remainder of the period being used for mass games.

b. Located near the outdoor gymnasium is a completely equipped football field. A natural amphitheater was selected for this site, and although no benches or stands have been constructed, 7,000 persons may easily view a game played on this field. It is also intended to use this field for interorganization soccer games.

c. Swimming pool, section B: In the spring of 1918, under the supervision of the Army engineers, a depression formed by an old stone quarry in section B of Camp Greenleaf was thoroughly cleaned up and all surface drainage and seepage removed by means of proper sloping of the banks. In addition, the sides and the bottom of the pool were coated with cement, thus avoiding contact with any substance except the original stone of the quarry.

As completed, this pool forms a body of water averaging about 240 feet in length, 75 feet in width, and from 3 to 15 feet in depth. Its capacity is 969,150 gallons and accommodates daily approximately 1,200 men. The pool is equipped with three spring boards and sufficient equipment for water polo games. On one side of the pool there is a safety zone of shallow water with a wire-netting partition, where nonswimmers may enjoy themselves without danger. The entire pool, with complete equipment, represents an expenditure of nearly \$9,000, which was borne in large part by the local branch of the American Red Cross. Through the generosity of this organization, 600 bathing suits are available for the use of the men of Camp Greenleaf. A bathhouse is located conveniently near the pool. Sterilization of the water is provided for by means of an electric pump which forces the water through a chlorine tank, thence out into the pool by means of a spray from a 6-inch pipe, aeration being thus provided. At intervals, depending on the extent to which the pool is used, chemical and bacterial analyses are made of the water. All men entering the pool are required to take a thoroughly cleansing shower bath, and in addition are at the same time inspected for any sign of skin disease. As a result of these precautionary measures, there has at no time been found any dangerous element in the water.

(4) Athletic entertainment: Instruction is given in swimming, boxing, and wrestling. Swimming meets are held, and such special features as a Wild West show, boxing and wrestling bouts, etc., are staged from one to three times a week in all open-air theaters.

D. *Education*.—A school for illiterates has been based in most sections of the camp upon that worked out in the detention camp, where it was found highly desirable to have several small schools, held nightly from 6 to 7 p. m. in mess halls adjacent to the several company streets, rather than to attempt to hold a single large school where much valuable time would invariably be lost. In these schools the morale sergeants act as principals, and select other teachers from their respective companies, to give instruction under the guidance of the chaplain and the Young Men's Christian Association educational secretaries.

E. *Publicity*.—(1) News bulletins: Beside the information tent in the detention camp is a large bulletin board labeled, in letters conspicuous from a distance, "Information." A similar board has been or is being constructed near the morale headquarters in each of the other sections of the camp. On this board are posted news bulletins of current events, especially with reference to the favorable progress of the war; entertainment programs; notices of athletic games and scores; and such general material as maps (both local and war maps), letters from the front, war poetry, clippings, etc.

(2) Two or three times a week, in the various airdromes, five-minute talks are delivered, usually by a Young Men's Christian Association secretary, describing the progress of the war

and illustrated by means of lantern slides. Slides are used also in connection with the motion pictures to make announcements, to teach the camp songs, and to summarize the war news of the day.

(3) A series of posters on morale subjects is being designed, some with reference to the early stages of recruit life, others dealing with the later developmental phases of a military career. Five expert illustrators work under the immediate direction of morale headquarters, having in view a series of art posters for use in connection with the Liberty loan campaign.

(4) A "departure card" of postal-card size has been designed, and is being printed for use when a soldier is transferred to a new organization. A cartoon covering one-half of this card is amplified by means of a legend as follows:

Dear-----

Here we are at the next stopping place *on our way to Berlin*. We have just been transferred here. You see, we are always moving, and in the right direction!

Be sure to write me at once. Use the new address given below and your letters will not be delayed.

As ever yours,

My new address is:

When a soldier is transferred from the detention camp to some other section of Camp Greenleaf, he promptly receives one of these cards and is required to send it home, in order that his people may have prompt notice of his new address. A series of such cards, different in details, but with a general morale purpose, are designed. Whether transferred or not, soldiers in this camp are required to write home at least twice each month, and a roster is kept to see that they do so.

(5) Through the courtesy of the Young Men's Christian Association and the local editor of *Trench and Camp*, one or more pages of this publication are placed at the disposal of the morale organization each week. This space is utilized for the printing of entertainment and athletic programs, for cartoons, and for such literature in prose and verse as may be devised to further the interests of soldier morale. This privilege also enables the morale staff to advertise various features of their work—e. g., the activities of the entertainment company—more widely and more promptly to the soldiers at large than would otherwise have been possible.

(6) A series of talks upon such topics as the following: "Why we are at war," "Why we are sure to win the war," "Traditions of the American Army," "Opportunities for self-improvement in the Army," "What victory will mean to me," "The necessity for discipline and obedience," "Ten reasons why we are at war," "A message to Garcia," by Elbert Hubbard, have been prepared and distributed to company commanders for use in their daily talks to the men of their command, and at present a large number of four-minute talks are being prepared, to be given either by company commanders or by morale sergeants during rest periods at drill or upon other frequent and informal occasions.

(7) Several plans are contemplated for widening the scope and usefulness of this publicity department. For instance, it is proposed that further efforts be encouraged to acquaint the registrant with the sort of conditions which he will meet when he actually enters the Army, giving him information concerning his equipment and the new life as he will find it, in order to allay foolish and unnecessary but very real fears of anticipation. It is hoped to make contact with civilian news sources, with a view to the minimization of the difference between the civilian and the military attitude. As he becomes better informed the young soldier will become the more readily amenable to Army discipline and will come the more quickly to sympathize with Army ideals.

F. *Special work among negro troops.*—The negro soldier presents a distinct morale problem, particularly with reference to the organization and conduct of athletics and entertainment. Since he is not permitted to attend the group entertainments or to take part in the general athletics, it is found necessary to develop these morale activities within the negro groups. Special entertainments are staged for the negro troops in a tent furnished for this purpose by the Young Men's Christian Association. Athletic games and contests are organized within the colored group, and sufficient equipment for this purpose is provided.

Although the appointment of white morale sergeants for colored units brought good results, it was deemed advisable to select colored soldiers with the proper educational qualifications for this purpose, since they could naturally make more intimate contacts with the men.

G. *Mental attitude of recruits*.—A questionnaire has been devised and is being printed in order to determine, upon the basis of 15,000 answers from recruits in the forthcoming draft, the mental attitude of the average soldier during his first weeks in the Army. In so far as it may be unfavorable an attempt will be made to offset it by means of specific and carefully directed propaganda. The questionnaire follows:

Date.....

(The name is not to be given.)

Town..... County..... State.....

How long in the Army.....

Married..... Single..... Family..... How many children.....

Age..... Occupation..... Wages.....

Where born..... Education.....

1. Were you anxious to get into the Army?
2. Is the Army life what you expected, or better, or worse?
3. Did you leave things at home in good condition? If not, what is the trouble?
.....
4. How often do you hear from home?
5. How many letters do you write a week? To whom?
6. Do you get enough to eat?
7. Do you think you are overworked?
8. Do you like to drill?; to salute?; to say "Sir" to officers?
9. Do you get all the information you desire about the Army? If not, what is lacking?
10. From whom have you learned most about what you are to do?
11. Do you understand why you are inoculated ("shot")? Did you dread it?
12. Do you attend the entertainments regularly?
13. What kind of entertainment do you like best?
14. Have you learned the Army songs? Which one do you like best?
15. How would you prefer to spend your spare time?
16. Are you anxious to get to France?
17. Does the uncertainty of what will be done with you bother you?
18. When the war is over would you prefer to continue in the Army or go back home?
19. Do you dread the future or look forward to it?
20. What bothers you most?
21. What has helped you most in the Army?
22. Do you feel that anyone has been unkind to you or mistreated you Who?

H. *Miscellaneous*.—(1) Instructions are given to the chaplains and other morale officers that men shall be particularly warned against the offense of A. W. O. L., since it is found in this camp that a very large majority of court-martial cases are of this sort. Criminal offenses are rare.

(2) Acting morale sergeants, when their service justifies it, are promoted to corporals, sergeants, and sergeants first class. It is hoped that the value of morale work might become sufficiently widely recognized that, to the rare man of the type required, in order adequately to exercise the functions of a morale sergeant the open road to promotion may be offered. This will mean that such a man might look forward to an earned commission. Otherwise there is danger that these desirable men, seeing no future, may strive for transfer to other branches of the service, and thus become a loss to morale work at the very time when their experience make them particularly valuable.

GENERAL INSTRUCTION FOR OFFICERS

While the general course of instruction for officers was prescribed by the Surgeon General, the method of imparting this instruction was left entirely in the hands of the camp commander. After much thought it was decided that the university method of teaching should be adopted and that there should be one basic course of three months' instruction for the entire camp. Clustered around this basic course a number of special courses were to be added as fast as possible, but the essential feature, the basic course, was not to be disturbed by these additions.⁶ By this it was meant that even if an officer were assigned to a special course he would still continue to take the basic instruction. These special classes were not meant to be substitutes but additional courses. Lectures in the basic course were given by the best qualified officers and, as far as possible, no officer was to be called upon to instruct in a variety of subjects.

At first all instructors were required to attend all lectures so that they would be familiar with the ground covered by the lecturer.¹⁹ After the lecture was given, the student officers were required to carefully study the subject and to recite on the subject the next day. In the beginning the instructors who conducted the recitations were the original Regular and National Guard officers detailed to the camp, but as instruction progressed the company officers were able to take up this work and conduct the recitations in their companies.⁶ The companies were further divided into smaller groups under student non-commissioned officers who conducted quizzes. As the original instructors were gradually relieved from the duty of conducting these recitations they were intrusted with the supervision of the recitations. These supervisors also kept in close touch with the individual officers to observe their progress and make recommendations for assignments of those qualified.¹⁹

Existing circumstances did not permit the ordering of student officers to the camp in groups for a definite period of instruction so that the whole body could begin the course together. They straggled in gradually throughout the history of the camp. To combat this evil all officers reporting after the beginning of each course were required to attend night quizzes in their companies.⁶ ⁷² These were held by the best qualified student instructors and were intended to bring the training of the individual officers up to one standard. Those reporting during the latter half of the course could not well do this on account of the large amount of instruction already given. These took all the work they could grasp and were enrolled in the next class.⁶

The three months' basic course outlined below was intended to cover the duties of a medical officer very thoroughly, but, unfortunately, due to urgent military necessity, many officers had to be detailed away from camp before the course was completed and therefore these men were only partially trained.⁷²

Within a short time after the opening of the camp the most promising of the student officers were being utilized as instructors. At first they were largely employed as company officers, drill instructors, and quiz masters. Later on those showing energy and ability were detailed as junior instructors. From the time of the opening of the camp one of the principal objects sought was to

prepare reserve officers for duty as instructors and administrative officers so that they could take over the administration and instruction of the camp. A number of reserve officers became very proficient teachers of Medical Department administration and the duties of medical officers in the field.

All officers reporting for instruction were assigned to the medical officers' training group. Each officer was given an examination by a board of medical examiners composed of the directors of the various schools, to determine his professional qualifications. All officers were then required to take the basic course, which primarily consisted of three months of intensive study along medico-military lines. Every student officer was required to take an oral examination in medicine and surgery and in any special branch of medicine in which he had previously received special training or in which he considered himself qualified. This examination was held, as has been stated before, at the time of entrance into the camp. Those men who were found to be poorly qualified professionally were sent to a school of either medicine or surgery or to both, if found necessary. These courses consisted of 15 lectures and quizzes in each subject. The poorly prepared students were required to attend the lectures in these courses regularly, in addition to the regular camp instruction. At the end of each course, a written examination was held and anyone who failed in this examination appeared before a board to determine whether or not he should be retained in the service. The chief object of the courses was to give the men a review of the essential features of medicine and surgery with which they should be familiar before being placed in positions of responsibility. If any of the student officers were found to be so deficient in professional qualifications as not to justify being sent to these courses of instruction they were sent before a special board, which was convened under War Department instructions.⁷³ After considering the man's professional rating and his general personal equation, the board then decided whether it would be to the best interests of the service to retain him or to have him honorably discharged as not suitable for the service; recommendations were made accordingly. It was a function of this board to determine, as nearly as possible, the exact professional qualifications of the men, with a view to recommending them for the positions for which they were best suited, and to see that they were given the necessary instruction whenever further training was needed.⁶

One week after their arrival in camp the student officers were classified by the board as follows: ⁶ Class A: Officers partially qualified and available as instructors along certain lines. Class B: Officers who had received some instruction, and who were qualified as instructors in any line. Class C: Officers who had received no previous instruction. Promotion to and demotion from each class continued throughout the entire instruction period. With the exceptions noted above, all student officers were held in class C, and later an additional class, D, was added, from which they were advanced to grades B and C by their company commanders as they improved in efficiency. Grade A was given only on the recommendation of the battalion commanders to the commander of the group who had the candidates examined. This examination was held by the senior instructor and his first assistant, and the student was obliged to pass the examination to qualify for the grade.⁶ At the termination

of the course, assignments were to be made for those remaining in class A. This system did not remain long in force due to the fact that a great many officers had to be ordered to other camps before the original three months' course was completed.

Cadet captains of companies were appointed by battalion commanders and held office for two weeks.⁶ Each battalion commander had five instructors who assisted him in the instruction and administration of the battalion. These instructors were grade A men, who were recommended by him to the group commander, and if they met with the approval of the latter officer, were detailed for the work. One of these instructors acted as battalion adjutants and the others as permanent company commanders.

The schedule for the basic instruction was outlined as follows:⁷⁴

FIRST WEEK

6 a. m.-----	Reveille.	11.30 to 12. 55----	Dinner.
6. 15 to 6. 30-----	Setting-up exercises.	1 to 1. 55-----	Medical Department drill.
6. 35 to 7. 25-----	Breakfast and police of quarters.	2 to 2.55-----	Lecture (b).
7. 30 to 8. 25-----	Foot drill.	3 to 4-----	Recitation, except Saturday.
8. 30 to 9. 25-----	Foot drill.	4. 15 to 5. 15-----	Instruction in French, except Saturday.
9. 30 to 10. 25-----	Lecture (a).		
10. 30 to 11. 25----	Recitation, except Monday.		

LECTURES

Monday:

- (a) Address by commandant.
- (b) Customs of the service.

Tuesday:

- (a) Personal equipment of the sanitary soldier. Field and surplus kits.
- (b) Care and maintenance of soldier's equipment.

Wednesday:

- (a) Duties of the soldier.
- (b) Duties of the soldier.

Thursday:

- (a) General organization of the military forces.
- (b) General organization of the Medical Department for war.

Friday:

- (a) General organization of the Medical Department for war.
- (b) Nature and employment of regimental medical supplies.

Saturday:

- (a) Nature and employment of regimental medical supplies.
- There was no afternoon work on Saturday.

SECOND WEEK

6 a. m.-----	Reveille.	10. 30 to 11. 25--	Instruction (b).
6. 15 to 6. 30-----	Setting-up exercises.	11. 30 to 12. 55--	Dinner and recreation.
6. 35 to 7. 25-----	Breakfast and police of quarters.	1 to 1. 55-----	Recitation on 9.30 instruction. Officers to be graded on all recitations.
7. 30 to 8. 25-----	Foot drill. Class A men to act as instructors for student companies and enlisted recruits.	2. 15 to 4. 25-----	Recitation on 10.30 instruction.
8. 30 to 9. 25-----	Same as preceding hour.	4. 30 to 5. 15-----	Instruction in French.
9. 30 to 10. 25-----	Instruction (a).	6-----	Supper.

LECTURES

Monday:

(a) A. R. 1471 to 1473, 1486 to 1488, M.M.C. 206 to 208, 12, 13, 18, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46.

(b) Papers connected with sick call; Form 71 M. D., and Forms 332 to 339 A. G. O.

Tuesday:

(a) M. M. D. 427 to 464 (four days allowed to complete these paragraphs).

(b) Papers connected with S and W report (four days allowed to complete this instruction).

Wednesday: Same as Tuesday.

Thursday: Same as Tuesday.

Friday: Same as Tuesday.

Saturday: (a) and (b) Talk on sanitary inspections, followed by an actual inspection of the entire camp by the student body under the direction of their company officers.

Saturday afternoon, 2 to 4, construction of camp sanitary apparatus.

THIRD WEEK

6 a. m.-----	Reveille.	9.30 to 10.25-----	Instruction (a).
6. 15 to 6. 30-----	Setting-up exercises.	10.30 to 11.25-----	Instruction (b).
6. 35 to 7. 25-----	Breakfast and police of quarters.	11.30 to 12.55-----	Dinner.
7.30 to 8.25-----	Foot drills or litter drill.	1 to 1.55-----	Recitation on 9.30 in-
	Class A men acting as instructors.	2.15 to 4.25-----	struction.
8.30 to 9.25-----	Same as preceding hour.	4.30 to 5.15-----	Recitation on 10.30 in-
			struction.
			Instruction in French.

LECTURES

Monday:

(a) M.M.D. 182 to 203, 414 to 417, 634, 153, 248 to 262. A. R. 1386, 1387, 283 to 290, 1447, 1448, 1450 to 1452, 1454 to 1456, 1461, 1462, 316 to 324.

(b) Sanitary reports. Hospital fund.

Tuesday:

(a) M.M.D. 496 to 508, 512 to 526.

(b) Property papers, I and I reports and boards of survey (four days allowed for this).

Wednesday:

(a) A. R. 657 to 671, 673 to 701.

(b) Same as Tuesday.

Thursday:

(a) A. R. 702 to 703, 710 to 726.

(b) Same as Tuesday.

Friday:

(a) A. R. 903 to 912, 914.

(b) Same as Tuesday.

Saturday:

(a) Relation of Medical Department to rest of Army.

(b) Sanitation and instruction similar to previous Saturday.

Saturday afternoon, 2 to 4, practical sanitary work.

FOURTH WEEK

6 a. m.-----	Reveille.	9.30 to 10.25-----	Instruction (a).
6.15 to 6.30-----	Setting-up exercises.	10.30 to 11.25-----	Instruction (b).
6.35 to 7.25-----	Breakfast and police of quarters.	11.30 to 12.55-----	Dinner.
7.30 to 8.25-----	Monday, Tuesday, and Wednesday, tent pitching—shelter and pyramidal.	1 to 1.55-----	Recitation on 9.30 in-
		2.15 to 4.25-----	struction.
8.30 to 9.25-----	Same as preceding.	4.30 to 5.15-----	Recitation on 10.30 in-
7.30 to 9.25-----	Thursday, Friday, and Saturday, foot and litter drills.	6-----	struction.
			Instruction in French.
			Supper.

LECTURES

Monday:

- (a) First aid, using soldier equipment.
- (b) Examination of recruits, recruiting papers, and finger prints (four days allowed).

Tuesday:

- (a) Nature and employment of regimental medical supplies.
- (b) Same as Monday.

Wednesday:

- (a) Same as Tuesday.
- (b) Same as Monday.

Thursday:

- (a) Military hygiene and sanitation (based on first and second chapters, Lelean).
- (b) Same as (a).

Friday:

- (a) Military hygiene and sanitation (based on third chapter, Lelean).
- (b) Field service regulations (one-half of book).

Saturday:

- (a) Field service regulation (second one-half of book).
- (b) Recitation on field service regulations.

Saturday afternoon, 1.30 to 2.30, continue (b).

The schedule for the remaining two months was identical in form, being changed in detail to suit the individual subject.

The foundation of the military instruction follows:⁶

1. *Physical instruction*.—(a) Regular and systematic exercises were prescribed. All student officers were given at least one-half hour a day in this work, and most officers received two hours equitation per week. Those officers who were poorly developed were given special attention, particularly those of 40 years and upward who could not stand the more strenuous exercises provided for the younger men.

2. *Military drill*.—(a) School of the soldier and the detachment. Each company for one hour daily was split up into groups of one or more sets of fours, and each man was given opportunity to drill the detachment for a short period to give him confidence and training in handling men.

(b) Company and battalion drills were held daily for periods of from 15 to 30 minutes, at the discretion of the battalion commanders.

(c) Litter drill for one hour in the afternoon by sections of each company. Special attention was paid to the loading and unloading of the litter.

(d) Practice marches were held at intervals in the place of drill, when the battalion commander so ordered.

(e) Practice in giving commands for one-half hour, or three times a week, to small groups.

(f) Each battalion was given at least one three-day hike with a field hospital company and an ambulance company, where actual field conditions were encountered.

The following order gives a clear understanding of the practice marches for student officers:⁷⁵

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., May 31, 1918.

General Orders, No. 51.

1. A series of practice marches for student officers, to begin on Monday, June 3, and continue until further notice, is hereby established.

For the present, these marches will be made to the Government rifle range, Catoosa Springs.

2. Each practice march will cover three days. Weather permitting, it will begin on Monday and Thursday of each week. Each student battalion will make not less than one practice march monthly.

3. Marches will be made by student battalions, separately and in succession. All personnel of the battalion, other than the sick and two student officers in each company to be left in charge of barracks and property, will make the march. Company commanders will satisfy themselves as to the physical fitness of all who take the march and insure that they are properly shod.

4. The rear of the student officers column will clear the camp not later than 6.30 a. m. at the cantonments formerly occupied by the 81st Field Artillery, where it will be joined by the sanitary units designated to participate in the march.

5. Each officer will carry on his person light field equipment, to include ration bag, raincoat, shelter tent half with pole and pins, mess kit, and canteen.

6. Each officer will be entitled to have transported for him, by truck, one small bedding roll, to include canvas roll, mattress, not exceeding two blankets, and such underclothing and toilet articles as may be necessary.

7. No separate mess for student officers will be provided, but they will be subsisted from the messes of the ambulance company and field hospital company.

Rations for two and one-third days will be carried. The company funds of the ambulance company and field hospital company will be entitled to reimbursement from the officers' mess for the cost of rations consumed, and to receive in addition a gratuity of not exceeding 25 cents for each student officer thus subsisted.

8. The commanding officer, hospitals and trains group, will designate one ambulance company and one field hospital company, both animal drawn, to accompany each battalion. The above organizations to carry full field equipment, tentage, both light and heavy, and supplies. A water cart will accompany these units.

He will also provide motor transportation for the bedding rolls above authorized to be carried for officers.

9. The commanding officer, student officers' group, will designate such instructors to participate in the march or campfire conference as may be necessary to proper training.

10. The senior instructor or organization commander with the command will command the whole, and be responsible for the proper execution of the provisions of this order.

11. The first day's march will be from headquarters, Camp Greenleaf, to the springs at the Lansford farm, distance 6.7 miles.

The march will be used as an object lesson in route marching, but a halt of 10 minutes, after every 20 minutes of marching, will be required.

Student officers showing any evidence of distress will be relieved of their packs, or, if necessary, ordered into ambulances for transportation. Company commanders will be held responsible for this.

Both student officers and sanitary units will bivouac in shelter tents. Student officers will be required to individually cook their own supper from the ration.

Drinking water will be sterilized by chlorination in the Lyster bag.

During the day, and at the campfire conference in the evening, practical instruction will be given in conduction of marches, care of feet, laying out of camps, shelter tent pitching, camp cookery, elementary sanitation, etc.

12. The second day's march will be from the springs at Lansford's farm to the rifle range, Catoosa Springs, distance 7.4 miles. It will be utilized for instruction in route marching as on the previous day.

At this camp, the full tentage and medical department and other equipment of the ambulance company and field hospital company will be pitched, displayed, and its use explained.

The internal economy of such organizations will be discussed and their tactical use in war outlined. The use of cover, terrain, etc., will be discussed.

13. On the third day the equipment of the ambulance company and field hospital will be repacked, the tentage struck, and the transportation loaded. These units will then return independently to Camp Greenleaf.

The student officers will visit the target range, be briefly instructed in small-arms fire, penetration of missiles, trajectories, etc., and, if possible, see a demonstration of rifle and machine-gun fire. If found practicable, a limited amount of pistol shooting by student officers may be had.

In the afternoon the student officers will return to Camp Greenleaf, arriving by retreat, in motor ambulances or motor trucks, which will be sent out for the purpose by the commanding officer, hospitals, and trains group.

14. In case of severe rain, the heavy tentage of field hospital and ambulance company may be used for shelter by student officers.

15. Other than cooking, all work pertaining to the comfort and instruction of the student officers will, as far as possible, be carried out by them.

16. Great care will be taken to have camp sites scrupulously clean and an object lesson in camp sanitation.

17. The quartermaster will make the necessary arrangements to secure the camp sites required, provide the necessary fuel and Havard box latrine accommodations, and accomplish the removal of refuse from the picket lines.

18. The commanding officer, hospitals and trains group, will provide for the permanent marking, in respect to their component groups, of the camp sites to be successively occupied. He will also maintain a detachment of 1 corporal and 4 privates on the Medical Department camp site at the rifle range for the purpose of maintaining scrupulous cleanliness and sanitation of this site.

By order of Colonel Munson:

E. S. SLEDGE,
Major, M. R. C., Adjutant.

Officers were given as thorough instruction in Army Regulations, Manual for the Medical Department, military law, and Field Service Regulations as the time permitted. They were given, in addition, a certain degree of instruction in those principles of military surgery and medicine with which every officer should be familiar. This instruction was given by officers who were qualified along the lines in which they were called upon to instruct.⁶

In September, 1917, stenographic notes were taken of all lectures, the transcripts of which were printed and issued to the classes at the cost of printing, the purpose being to give all student officers a textbook on medico-military subjects in a fairly condensed form.⁷

During October, 1917, the student companies were split up into single squads or groups of four for a large part of the drill period each day.⁸ The object of this plan was to give every man a chance to take charge of and drill a squad. This plan was amplified and specially developed during November, both in foot drill and in litter drill, with beneficial results.

Beginning November 22, a medical officer of the day was appointed daily from one of the battalions, each battalion providing this officer for a period of one week.³ The duties of the officer of the day were in general as follows: (1) General oversight of company streets and buildings; (2) fire protection; (3) ventilation in barracks; (4) condition of bathhouses, with special reference to waste of water; (5) any special conditions that might arise and require to be reported.

After the lapse of several months orders were given that officers who had been reserved by the different professional divisions in the Surgeon General's Office, or who had been found qualified for special instruction by the professional examining board, were to take the basic course for two weeks, and at the end of that time were to be assigned to such special schools as their qualifications indicated.⁶ From the beginning men prominent in the specialties were used to give lectures in their particular fields. They were sent to the camp for that purpose and supplemented the instruction already given by the instructors permanently assigned to the camp.⁶

COURSE FOR LINE OF COMMUNICATIONS SERVICE

In November, 1917, the need for officers for duty with the line of communications being so great and the necessity for full military training for such service being less urgent, the following instructions were sent to the commandant:⁷⁷

NOVEMBER 28, 1917.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: Condensed schedule of instruction for medical officers under training with units for line of communications service.

1. This office is in receipt of the following order: "The Secretary of War directs that you expedite the preliminary training in the United States of service of the rear troops and that such training be reduced as far as possible so as to prepare these troops for service abroad at an early date."

2. In compliance with the above order, medical officers assigned to sanitary formations of the line of communications will receive a course of instruction lasting two months.

3. This course will be based on the general schedule for the training of medical officers in your camp, as set forth in Special Regulations, No. 49a, War Department, 1917.

It will, however, give a minimum of time to subjects relating to service with fighting troops in the zone of operations, and will place proportionately more emphasis on the professional matters and administrative requirements which assume so much importance in the service of the rear.

4. It is important, however, that medical officers for the present intended for service with the rear shall not be without reasonable instruction in matters relating to the zone of operations, since emergency may at any time require their detachment for service with troops at the front.

5. Where practicable, it is desirable that medical officers to be attached to formations of the rear should be given the full three months' basic course of your training camp, with the intensive training for these special formations to follow as a postgraduate course, so that the camps may turn out as comprehensively trained men as time may permit.

6. The schedule for the first month is as follows:

	Hours
Setting up (15 minutes daily for 26 days).....	6.5
Drills (marching, litter, ambulance, other means of transport, etc.).....	52.0
Inspections.....	4.0
Equitation, bridling, saddling, care of animals, etc.....	15.0
Tent pitching:	
Shelter tent.....	2.0
Pyramidal tent.....	2.0
Hospital tentage.....	6.0
Personal equipment of sanitary soldier.....	1.0
Field and surplus kits.....	1.0
Care and maintenance of soldiers' equipment.....	2.0
First aid, using soldiers' equipment only.....	2.0
Examination of recruits, with papers and fingerprints.....	6.0
Customs of the service.....	2.0
Duties of the soldier.....	4.0
Organization of military forces of the United States.....	2.0
Organization of Medical Department for war.....	4.0
Relation of Medical Department to rest of Army.....	1.0
Army Regulations.....	6.0
Manual for the Medical Department.....	12.0
Field Service Regulations.....	6.0
Methods of supply at home and in the field.....	2.0

	Hours
Paper work relating to the—	
Medical Department.....	8. 0
Quartermasters's Department.....	4. 0
Ordnance Department.....	2. 0
Military hygiene and camp sanitation.....	12. 0
Handling of ration and mess management.....	4. 0
Practical sanitary inspections.....	8. 0
Lectures on special subjects.....	4. 0
Total.....	180. 5

7. The schedule for the second month is as follows:

Setting up (15 minutes daily for 26 days).....	6. 5
Drills, marching, litter and ambulance.....	36. 0
Inspections.....	4. 0
The regimental detachment; its equipment, use, and internal administration.....	3. 0
The ambulance company; its equipment use, and internal administration.....	3. 0
The field hospital; its equipment, use, and internal administration.....	6. 0
The Medical Department in campaign.....	6. 0
The principles of sanitary tactics, and map reading.....	6. 0
The evacuation ambulance company; its equipment, use, and administration.....	2. 0
The evacuation hospital; its equipment, use, and internal administration (including its establishment and demonstration).....	12. 0
Paper work, relating to the Medical Department (continued).....	8. 0
Military hygiene and camp sanitation (continued).....	6. 0
Practical sanitary inspections.....	6. 0
Army Regulations (continued).....	6. 0
Manual for the Medical Department (continued).....	6. 0
Manual for Courts-Martial, and Military Law.....	8. 0
The Articles of War.....	1. 0
The Geneva and Hague conventions.....	1. 0
The Rules of Land Warfare.....	2. 0
Military surgery, including splints and splinting, infections, trench foot, etc.....	16. 0
Liquid fire, poison gases, protection against, symptoms and treatment (practical).....	4. 0
War psychoses and neuroses; shell shock, malingering.....	4. 0
Trench warfare, including demonstration of trench system.....	4. 0
The commoner diseases of troops in France.....	6. 0
The sanitary service, line of communications.....	2. 0
Hospital ships; ships for patients; hospital trains; trains for patients.....	2. 0
Base hospitals; their organization and management.....	2. 0
General hospitals; their organization and management.....	4. 0
Contagious disease hospitals; casual camps; convalescent camps; camps for prisoners of war.....	2. 0
Organization, functions and limitations of the American Red Cross.....	1. 0
The civil sanitary function of the Medical Department in occupied territory.....	1. 0
Lectures on special subjects.....	4. 0
Total.....	180. 5

8. Inasmuch as it is possible to supply only a part of the equipment of an evacuation hospital for training purposes at your camp, you should at appropriate times arrange for the pitching in connection therewith of such number of field hospitals as would provide the full tentage of an evacuation hospital, together with such of its equipment as are included in the supplies of field hospitals.

9. When an evacuation hospital is pitched, the opportunity should be taken advantage of to demonstrate the magnitude and equipment of this formation to all officers and men under training in your camp, as well as the personnel assigned to evacuation hospital duty.

10. The training of the enlisted personnel of evacuation, base, and special hospitals should be approximately the same as that now given the personnel of field hospitals, but

leaving out most of the training relating to the management of wheeled transportation, reducing to the minimum instruction relative to the functioning of regimental detachments, ambulance companies, and field hospitals, and emphasizing practical training in ward nursing, surgical assistance, including splint making, dispensary work, care of property, and cooking and mess management.

11. The training of enlisted men for evacuation ambulance companies should be the same as for divisional ambulance companies, substituting more training in bandaging, first aid, splinting, and emergency nursing for a corresponding amount of the field work prescribed in your general schedule.

12. The training of enlisted men for sanitary squads should be approximately the same as for evacuation ambulance companies, but giving a competent knowledge of horsemanship and the use of motorcycles, and substituting for nursing a thorough training in sanitation and hygiene, which latter should relate not only to military camps and stations but to such civilian communities as would be liable to be occupied as billets by troops in France and elsewhere.

13. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON,
Colonel, Medical Corps.

PHYSICAL INSTRUCTION FOR OFFICERS

The physical instruction of the officers always received considerable attention and was conducted by a qualified instructor. It was found that the regular course was too strenuous for the middle-aged officers, and as their number increased, the work was modified by the following order:⁷⁸

General Orders, No. 58.

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., June 6, 1918.

1. The physical instructor of Camp Greenleaf will be responsible to these headquarters for the proper conduct of all matters relating to physical training of officers and men of this command. He will also serve as athletic officer for the camp.

2. All student officers will be given one-half hour's physical training daily, except Saturday and Sunday, unless excused by the camp surgeon.

3. Officers entering the camp, and following their physical examination, will be divided into two classes for physical training; one class composed of those 40 years of age or less, and the other of those over 40 years of age. Officers who may be under 40 years of age, but who, in the opinion of the camp surgeon, are not yet fit to undertake more advanced physical training, will be assigned to the latter class.

4. The physical training of the first-named class will have the purpose of putting participants in excellent physical condition in the shortest practicable time. The exercises, though not arduous, will be comprehensive and progressive.

5. The physical training to be given the latter-named class will, for the first three weeks after entrance, be comparatively less severe. It will be carefully graduated and closely supervised by the physical instructor, who will see that officers receive any individual attention which they may require. He is authorized to assign to certain groups for special training such officers in the second class, as, in his opinion, require a modification of class work.

6. At the end of the three weeks' period, the members of the second class will be examined by the camp surgeon. If certified to by him as to physical competency, they will thereafter be given the more intensive course of physical training carried out by the first class.

Officers whose physical competence for more advanced training is not certified to by the camp surgeon will be continued with their original class until such certificates have been given or other action has been taken in their cases.

7. Physical exercises of student officers will be carried out separately by battalions and for the class of officers over 40 years of age.

The physical instructor will designate assistants who will be in direct charge of each class.

The course of instruction at the camp began to slow up after the signing of the armistice, and in December was discontinued except for some further work conducted by the special schools.⁷²

The following report of the senior instructor sums up generally the aims and the results accomplished during the existence of the camp:⁷²

OFFICE OF THE SENIOR INSTRUCTOR,
Camp Greenleaf, Chickamauga Park, Ga., January 5, 1919.

From: The Senior Instructor.

To: The Commandant.

Subject: Monthly report of instruction, December, 1918.

The course of instruction at the M. O. T. C., Camp Greenleaf, was interrupted and finally terminated during the month of December, except for the special school of Roentgenology, which is still operating and will probably continue to operate during the month of January, or at least the greater part of it.

The school of gas defense discontinued instruction December 11, with the authority of the War Department. The general basic course was discontinued December 20 in order not to delay the demobilization and discharge of student officers. The special schools, with the exception of the X-ray school, closed December 23, on account of the discharge or assignment of the officers undergoing instruction in these schools. As mentioned above, the only instruction now being given is the uncompleted course in the school of Roentgenology.

No changes or modifications of the system of instruction were introduced during the month. A few over 1,600 student officers participated in the basic and special courses. New courses were begun December 1, but none of them was completed. The special school schedules were carried out with success and enthusiasm to the last, and too much credit can not be given the directors and instructors for their excellent work and extremely gratifying results obtained.

Most of the work in the basic course during the past year has been given by the senior instructor and his assistants, Lieutenant Colonel Darby and Majors McKellar and Rubert. The instructors in the basic course have worked continuously and faithfully, much of the time under adverse conditions and with little other than a sense of duty and patriotism to stimulate and encourage them. During the second half of the year, Lieutenant Colonel Williamson and Major Webster arrived, removing much of the burden of teaching from the others, and did their work in a most satisfactory and enthusiastic way.

My experience during the past 19 months had demonstrated conclusively that the art of instructing successfully can not be acquired by many, even though the instructor conscientiously apply himself. Conversely, even those who possess talent and ability do not achieve success unless they work diligently and zealously.

I take this opportunity to express my appreciation of the talent, ability, diligence, and devotion shown and success attained by the corps of instructors at Camp Greenleaf during the past year. I believe few realize the difficulty attended with getting the average doctor direct from civil life interested in and acquainted with military administration and the non-professional duties of medical officers, especially where this has to be done far from the glamour and spectacularity of the theater of operations. The stimulation, encouragement, and animation felt by participants in the sphere of active martial operations is lacking in a training camp and can only be offset where the same courses with new, uninterested students must be repeated time after time, by a rigorous appreciation of duty and the small satisfaction of achieving a modicum of success under uninteresting, adverse conditions.

Since the M. O. T. C. was established at Camp Greenleaf 19 months ago, 12,000 officers have passed through. Unfortunately many of them, due to exigencies of the service, did not complete the prescribed course of training, and not a few of them had only started the course of instruction when ordered away.

Two heavy handicaps have confronted the instructors since the establishment of the training camp—continuous arrival of student officers at camp, making it impossible to put classes through as a unit; removal of student officers prior to completion of the course. Of the two evils, the latter is the greater, as most of these men are imperfectly trained. The

first difficulty can be partially overcome by increasing the number of instructors or unduly increasing the work of the instructor, both undesirable features, usually resulting in the instructor rapidly wearing out or his inability to teach with the desired zeal and enthusiasm. I strongly recommend that if training camps are to be organized in the future every effort be made to remove or overcome these encumbrances.

ROGER BROOKE, *Colonel, M. C.*

GENERAL INSTRUCTION FOR ENLISTED MEN

When the camp was first opened the general instruction of the enlisted men was outlined in the following order:⁷⁴

*	*	*	*	*	*	*
7. As enlisted men report for duty they will be immediately organized into provisional companies as follows:						Men
Provisional motor field hospital companies.....						160
Provisional mule-drawn field hospitals.....						162
Provisional motor ambulance companies.....						238
Provisional mule-drawn ambulance companies.....						300

The first company will be a motor field hospital company.

The second company to be formed will be a motor ambulance company.

The third company to be formed will be a mule-drawn field hospital company.

The fourth company to be formed will be a mule-drawn ambulance company.

8. The provisional director of field hospital companies, as designated in order, will, subject to the approval of the commandant, select two officers from the First Field Hospital of Tennessee National Guard, as his assistants.

Likewise, the provisional director of ambulance companies, as designated in orders, will select two assistants from the 1st Ambulance Company Tennessee National Guard.

9. Provisional companies will be attached for rations to the National Guard companies present in camp until further orders.

10. Upon the recommendation of directors of units "cadet officers" will be detailed by the commandant to perform all of the duties of company officers in each of the provisional companies. It is desirable to change these "cadet officers" as frequently as possible so that a maximum number may have the valuable experience thus afforded. Qualified officers and officers who show no promise of rapidly qualifying for duty with units will be recommended for transfer by directors without delay.

11. Directors of units will be held responsible for the training and discipline of their commands. Training will be along the lines as directed by the commandant and will be coordinated with the general scheme of camp instruction. With these limitations, it is proposed to give directors of units every chance to get results per their own methods.

12. Directors of units will decide upon the attendance or nonattendance upon routine instruction of members of their command. The purpose is to employ the time of every member of this camp to the best advantage.

13. Directors of units will make every effort to develop efficient none commissioned officers. With this end in view they will designate instruction scheduled for classes "A," "B," "C," which may seem to be advisable. This will be in addition to the instruction scheduled for class "D."

14. The first week in camp will be chiefly utilized for purposes of classification. Directors of units will be expected to select very promptly such men as are unfitted for advance instruction. These men will be eliminated from class lecture and quiz work as rapidly as possible, care being taken not to eliminate any man of potential though undeveloped capacity.

The course of instruction of recruits while in the recruit camp awaiting assignment to units began Monday, June 18, 1917. The recruit camp was divided into companies of equal size and number, and with an equal number of noncommissioned officers, Regular Army, assigned thereto. Both companies were under the command of the commanding officer of the recruit camp.⁵³ The following schedule went into effect on that date:⁷⁴

TRAINING

MONDAY

6.45 to 7.15 a. m.-----	Police of tents and camps.
7.15 to 7.30 a. m.-----	Setting-up exercises.
7.30 to 9.25 a. m.-----	Foot drill.
9.30 to 10.25 a. m.-----	Address by commandant, M. O. T. C.
1 to 1.55 p. m.-----	Drill.
2 to 2.55 p. m.-----	Talk on customs of the service by noncommissioned officers.
3 to 4 p. m.-----	First aid.

TUESDAY

6.45 to 7.15 a. m.-----	Same as preceding day.
7.15 to 7.30 a. m.-----	Same as preceding day.
7.30 to 9.25 a. m.-----	Foot drill.
9.30 to 10.25 a. m.-----	Demonstration of equipment of sanitary soldier by noncommissioned officer.
1 to 1.55 p. m.-----	Drill.
2 to 2.55 p. m.-----	Care and maintenance of soldier's equipment by noncommissioned officer.
3 to 4 p. m.-----	Personal hygiene by noncommissioned officer.

WEDNESDAY

6.45 to 7.15 a. m.-----	Same as preceding day.
7.15 to 7.30 a. m.-----	Setting-up exercises.
7.30 to 9.25 a. m.-----	Drill.
2 to 2.55 p. m.-----	First aid.
3 to 4 p. m.-----	Litter drill.

THURSDAY

6.45 to 7.15 a. m.-----	Same as preceding day.
7.30 to 9.30 a. m.-----	Drill.
9.30 to 10.25 a. m.-----	General organization of Army by noncommissioned officers.
10.30 to 11.25 a. m.-----	Method of rolling blanket roll.
1 to 1.55 p. m.-----	Drill.
2 to 2.55 p. m.-----	First aid.
3 to 4 p. m.-----	Shelter tent pitching.

FRIDAY

6.45 to 7.15 a. m.-----	Same as preceding day.
7.30 to 9.25 a. m.-----	Care of animals, talk by noncommissioned officers.
9.30 to 10.25 a. m.-----	Drill.
10.30 to 11.25 a. m.-----	First aid (Sylvester's method of artificial respiration).
1 to 1.55 p. m.-----	Drill.
2 to 2.55 p. m.-----	Camp sanitation, talk by noncommissioned officers.
3 to 4.30 p. m.-----	Clean up for Saturday inspection.

SATURDAY

8 to 8.25 a. m.-----	Inspection.
8.30 to 9.30 a. m.-----	Drill.

Noncommissioned officers in charge of instruction graded each man in drill, practical work, and recitation.⁸⁰

After the camp began to expand the recruits were rapidly assigned to sections where units were being organized.¹⁹

TRAINING THE RECRUIT

During the winter of 1917 and the spring of 1918, the detention group ran noncommissioned officers' and cooks' schools.⁸¹ Many of the men trained in these schools were retained as the permanent training cadre. Other platoon leaders and cooks were obtained from men having former military training in the service or at a military school and from those who had been cooks in civil life.

The daily schedule of training began at 7 a. m. and continued until 4.30 p. m. One hour after supper, from 6 to 7 p. m., during the summer, the companies were turned out for athletics under the direction of the company officer. An outdoor auditorium, seating 3,500 men, was constructed, and a show was run nightly from 7 until 9.30 p. m., under the direction of the morale and athletic officers. Two nights a week were devoted to wrestling and boxing contests. The others were filled with band concerts, vaudeville, etc., staged by the men themselves. Great rivalry was stimulated between the companies. Moving pictures, with excellent films, finished the evening's entertainment. After the recruit had completed the days' work and evening's entertainment, he was too tired and sleepy to get homesick, and found little time to get into trouble.

The morning work started with setting-up exercises for a half hour, given by an excellent instructor, to groups of from 500 to 1,000 men. The company officers and noncommissioned officers were present with each company to correct individual members and to aid the instructor. The company was divided into its platoons, squad and platoon drill being carried on until the company was ready to drill as a unit. The company officers had no other duties and could therefore spend their entire time in training. For a half-hour period each morning, some type of game was run in to rest the recruits from the monotony and to stimulate waning interest. Drill continued during the afternoon. One hour of this was devoted to instruction in the duties of the sanitary soldier, personal hygiene, sanitation, care of equipment, and other subjects a recruit should know. These talks were made very simple so that they were easily understood and were frequently repeated. The first 10 minutes of the talk was devoted to such subjects as, "Why we are at war," "The American Army," etc., which were gotten up by the morale officer to stimulate the recruit's interest and to aid him in thinking correctly. The Articles of War and pertinent camp orders were read and explained to all men during their first 48 hours in camp. If the recruit stayed in camp a month or longer instruction was given in litter drill, tent pitching, and more advanced work. It was believed that the recruit should first be made a soldier and later be trained for special work.

Athletic equipment for each company was purchased with the company fund. There were seven baseball diamonds in working shape on the drill grounds of the organization. Each company was supplied with baseball equipment, boxing gloves, basket balls, footballs, etc. The organization boasted the champion baseball team of the camps in the vicinity, and there was an excellent game on the home grounds twice weekly.

All enlisted men assigned to ambulance companies and field hospital companies during the early days of the camp received general instruction which was a continuation of that in the detention group. This comprised

school of the soldier, litter and bearer drill, tent pitching and striking, individual cooking, transmission of messages, first aid, and practice marches.

Each company was instructed in the pitching of a complete field hospital and upon its completion, in conjunction with the ambulance companies, combined drills and problems were given, making the picture realistic by caring for the wounded brought in from an imaginary firing line through ambulance-company dressing stations.

The course of training and instruction was conducted by the directors, who published at frequent intervals memoranda outlining the work. The work was laid out in a systematic manner and comprised not only the training outlined in the drill regulations for sanitary troops, but also a period of training for each company as soon as it had sufficient preliminary training. During field training the company was entirely self-supporting, living under canvas for 10 days or 2 weeks at a time and carrying out daily field exercises and practice marches.¹⁹

No occupational tables for Medical Department units were made by the committee on classification of personnel until late in 1918. This necessitated the compilation of tables in the camp itself so that men could be assigned to units according to occupational qualifications.^{82 83}

The training of the enlisted men was not entirely satisfactory even as late as September, 1918, due in great part to the urgent demands for men to fill numerous War Department requisitions. This is shown by the following memorandum:⁸⁴

HEADQUARTERS, DIVISION OF HOSPITALS AND SANITARY TRAINS,
Camp Greenleaf, Chickamauga Park, Ga., September 9, 1918.

Memorandum to Col. E. D. MUNSON:

The proper training of the enlisted men of this command has practically ceased. The requisitions of men to be sent elsewhere have mounted up to such a point that at the present time to fill these requisitions we will be obliged to take men from the draft, without their completing the two weeks' detention which has been required.

In the replacement group it has been impossible to give the men anything more than a short two or three days' instruction in military courtesies and what elementary foot drill can be given in that time. The men received from the detention camp in the replacement group are practically immediately assigned out, and leave as soon as transportation is available.

An attempt is being made to classify men according to the methods of the committee on personnel of The Adjutant General's Office but the demands for men have been so great that we have been obliged to send out classified men for general service. In this respect attention might be invited to the fact that a shortage of properly qualified men for the special technical schools is now being experienced, due to this method of assignment which has been forced upon us. On account of urgent telegraphic orders from The Adjutant General of the Army, we have also been obliged to send out 180 men to sanitary train of the 20th Division, Camp Sevier, S. C., at once. These men are no better than the men that the sanitary train could obtain from its own depot brigade.

In the motor group the same conditions obtain, with the exception that qualified motor-men are required to be held for motor units, and we have a few such men on hand who will be assigned out almost immediately. An effort has been made to hold in this group all of the men infested with hookworm in a separate battalion until they are cured, but this has not been found practicable; and we have been compelled to send men for overseas service who are not completely cured of the malady.

In the evacuation group the training of the men has consisted entirely of the school of the soldier, and the longest time these men have been in camp is an average of less than one month. No proper organization of these hospitals with their full permanent personnel has

been possible, and the men going out labeled "Evacuation Hospital No. ——" are only 100 men put together on a train, and their organization is bound to be extremely loose.

The same troubles exist in the hospital group, and though an attempt has been made to train men at general hospitals for ward duties, the number of such men we are able to spare for this training from the constantly moving organizations has been very small.

Every effort has been made, and is now being made, to take properly classified men from the draft and train them in the noncommissioned officers group, leaving them there for a full six weeks' training. Unfortunately, heretofore the number from which these men are taken has been so small that the noncommissioned group, instead of running a capacity of 2,000 men, is now down to less than 700; and we were unable to supply more than 73 noncommissioned officers for the large number of base hospitals recently ordered from this camp. The length of time which these men have been in camp will not average three weeks, and a great many are leaving camp now, or will leave in the next seven days, who have been in this camp less than two weeks.

W. N. BISPHAM,

Colonel, M. C., United States Army.

These difficulties in the way of the proper training of the enlisted men were noted also in the report of an inspection made of the camp on September 11. The following is a quotation from that report:⁴⁴

Men composing the units above referred to are being passed through this camp so rapidly that technical instruction, even of the most primary character, is out of the question. Men are being sent here by the thousands to be trained, presumably for certain definite hospital training, and almost before they are released from detention camp are sent out again. Under the present system this camp, so far as the enlisted personnel is concerned, is only a place where hospital units are thrown together. It is in no sense a training center. If it is desired primarily that the organizations being formed here should be partially trained before leaving this camp, a sufficient reservoir must be built up here to permit of all men being held here for at least two months. As the number and kind of units needed can certainly be approximated two months in advance, no reason can be seen why this should not be done. The present system appears to be extravagant and inefficient, through no fault of the local personnel, and is beyond their means to rectify.

During the month of October, 1918, though few men were received, owing to the influenza epidemic, very few departed, and therefore more time was given to the perfecting of the instruction of the enlisted men of the command.⁸⁵

SPECIAL INSTRUCTION FOR OFFICERS

Special instruction for officers was considered necessary shortly after the camp was inaugurated. In June, 1918, after a conference in Washington between the training division and the heads of the different professional divisions of the Surgeon General's Office, a percentage division of all medical officers was made, giving each specialty a certain percentage of the total officers enrolled.⁸⁶ This was used as a basis for the special instruction of officers at Camp Greenleaf and was outlined in the following order:⁸⁷

General Orders, No. 54.

HEADQUARTERS CAMP GREENLEAF,

Chickamauga Park, Ga., June 4, 1918.

1. The Surgeon General directs that in the training of medical officers the following figures should serve as a general guide to the probable nature of service, the proportion required in each class, and the ratio which should exist for each professional group. It is to be understood that these figures are to be regarded as approximate and not invariable.

2. Out of every 1,000 officers received for training, they should be divided and specially trained about as follows:

(a) For service in the zone of operations, with regiments, ambulance companies, and field hospitals, there should be trained 500.

This class of men should be relatively young, physically sound, mentally alert, who are qualified general practitioners and sanitarians, and who have qualities of leadership and manhood which appeal to men.

These men are, as far as possible, to be given the full basic course of three months.

Out of each 500 of the above, approximately 250 should be specially trained for regimental service, 125 for ambulance company service, and 125 for field hospital service.

(b) For service in the line of communications, home service, special duties, etc., there should be trained 500.

These men should represent the type remaining after the class mentioned in paragraph (a) has been deducted from the student group.

It may include more elderly men, those certified to as fit for home or special service only, and those sent for training by specialists divisions, and reserved for special duty therewith.

These officers should ordinarily take the abridged course of two months, with any special professional training desired in addition.

Out of each 500 in this group, it is desired by the Surgeon General that the following numbers, in each component class, be given special training in professional lines:

Head surgery (including eye, ear, nose, and throat, brain, etc.)	44
Roentgenology	50
Laboratory, sanitation and control of infectious disease	45
Neurology	20
Genitourinary	30
Orthopedic surgery	35
Tuberculosis examiners	20
Cardiovascular examiners, and general medicine	50
General surgery	175
Hospital administration	15
Not specified	16
Total	500

3. Facilities for training in accordance with the requirements of paragraph 2 will be provided accordingly.

4. Instructors in charge of the above courses will inform this office as soon as possible as to what changes or additions in personnel, accommodations, and equipment are necessary to their proper compliance with the instructions of the Surgeon General.

5. For the present, estimates should be based on the probable attendance of 1,500 student medical officers.

By order of Colonel Munson:

E. S. SLEDGE,
Major, M. R. C., Adjutant.

In accordance with these orders, the various schools for special instruction of medical officers were organized and conducted, with such changes as were necessitated by circumstances, throughout the life of the camp.

In addition to the professional instruction given in these special schools, the officers ordered to duty with the many units formed in the camp had to receive special instruction to fit them for active service with these units.⁷⁴

The special professional schools were given a definite stimulus when General Hospital No. 14 was placed under the command of the commandant of the camp, greatly enlarged, and reorganized as a teaching hospital. An excess staff composed of student officers was provided, and each clinical department of the hospital was under the direct control of the director of the school teaching

that specialty.⁶ The courses provided were not didactic, but entirely practical; and though the short time allotted was not sufficient to make specialists of the students, it permitted sufficient training to provide a body of excellent assistants in the different lines.

All units formed were kept fully officered, and vacancies were filled immediately by detail from the training companies. If they had not completed their basic course they were required to keep up with it until they had completed it. On account of their company duties not all of these officers could attend the lectures, but recitations were held for all in the different subjects.^{19 74}

Special courses were given by the several group commanders with the object of fitting these officers for active independent service. This instruction covered the administrative duties of company and hospital commanders and the administrative duties of their subordinates, the proper handling of enlisted men, and the methods to be used in the instruction of enlisted men.

A special class for the instruction of officers in the duties of a regimental surgeon was conducted at first in the hospital group and recruit camp. By this instruction it was intended to obtain a sufficient number of men specially qualified for this important duty.¹⁹ Later this method could not be pursued on account of the rapid transfer of student officers, only those receiving instruction in the special schools remaining sufficiently long to receive really worth-while instruction.⁶

SCHOOL OF MILITARY HYGIENE

The School of Military Hygiene was the first special school to be established at Camp Greenleaf,⁸⁸ and was organized early, with the idea that men trained along such lines would be necessary at once. Its object was the intensive training of medical officers in the field of camp sanitation.¹⁹

The curriculum was not laid down in its completed form at the start, but gradually developed as the school progressed. The basic course comprised didactic and practical instruction in the fundamental subjects of camp sites; drainage; disposal of kitchen, human, and animal wastes; policing of barracks and camps; water supply, including quality, quantity, and approved methods of purification; food, including mode of preparation, preservation, cleanliness of kitchens, and prevention of waste; insects; transmissible diseases and the methods of control. Practical field work was taken up and groups of students were assigned problems involving drainage, road construction, insect abatement, care of picket lines, construction and care of latrines, disposal of waste, kitchen inspection, construction and care of incinerators, and water purification and storage. Additional subjects covered dealt with pellagra, malarial fever, typhus fever, yellow fever, amebic dysentery, ankylostomiasis, vaccine therapy, causation factors in epidemics, special quarantine measures, flies and disease, rat proofing of buildings, first aid in sanitation, rural sanitation, sanitation in buildings, construction, building and disinfection, duties of a quartermaster's office, ship disinfection, operation of sewage disposal plants, ventilation, water purification, sanitary inspection, and mess management. These lectures were given by the instructors and also by such students as were qualified to lecture on such subjects.

The following is an outline of the course as developed:⁸⁹

DAILY SANITARY CLINICS

Theory of camp inspection.
 Theory of police duty.
 Care and construction of grease traps and incinerators.
 Care and construction of latrines, soak pits, and lavatories.
 Care of picket lines.
 Manure disposal.
 Fly and mosquito destruction.
 Septic tanks.
 Kitchen technique.

FIELD WORK (PROBLEMS ASSIGNED)

Drainage, ditching, subsoiling, use of blasting powder.
 Road building and grading.
 Inspection of heating, lighting, and ventilation of barracks.
 Map reading, contour sketching mounted and on foot, without use of instruments.
 Levels, with and without the use of instruments. Rat proofing, fumigation of buildings.
 Selection of stone and gravel, for building roads and filters, incinerators, etc. Plumbing, inspection; protection of plumbing against freezing.

Motor truck engines, care and use.

Nightly lectures on subjects that were germane to the sanitarian's duty. These lectures were given by members of the School of Hygiene, most of whom were specialists in their subjects.

Student officers were assigned daily to various organizations of this and surrounding camps to study camp sanitation.

LECTURES

Sept. 24..... Camp inspection.
 25..... Pellagra.
 26..... Malaria and mosquitoes.
 27..... Paper work in the Army.
 28..... Vaccine therapy.
 29..... Fleas.
 Oct. 1..... Rat proofing.
 2..... Customs of the service.
 3..... Rural sanitation.
 4..... Sanitary aspects of tuberculosis.
 5..... Hookworm.
 6..... Running a mess.
 8..... Duties of a quarantine officer.
 9..... Ship disinfection.
 10..... Military map making.
 11..... Amebic dysentery.
 12..... Refuse disposal.
 13..... Typhus in Serbia.
 16..... Kentucky privies.
 17..... Vitamines.
 17..... Military sketching (demonstration).
 18..... Amebic dysentery.
 20..... Carrel-Dakin methods.
 21..... Water purification.
 24..... Sanitary survey.
 24..... Food inspection.
 25..... Fatigue in trench life.
 26..... Yellow fever.

LECTURES—continued

Oct. 27..... Special quarantine measures.
 30..... Hygiene of ventilation.
 31..... Cerebrospinal meningitis.
 Nov. 1..... Sanitation and building construction.
 2..... Bubonic plague.
 3..... Military map reading.
 5..... Sanitary clinic.
 6..... Air sanitation.
 8..... Epidemiology.
 9..... Soils and drainage.
 12..... Common respiratory diseases in camp.
 13..... Treatment of contagious diseases without antiseptics.
 14..... Sanitation in the trenches.
 15..... Cerebrospinal meningitis.
 16..... Mosquitoes from an economic standpoint.
 17..... Yellow fever.
 20..... Operation of sewage disposal plants.
 21..... Rural sanitation.
 22..... Refuse disposal.
 23..... Sketch making.
 26..... Control of woodsheds.
 27..... Results of a sanitary survey.
 28..... Types of incinerators.
 29..... Height determination by slope board.
 30..... Practical leveling methods.

At first members of this school were required also to take the basic course, being excused only from military drill, but no student was assigned to the school until he had had at least two weeks drill with his company.¹⁹ Later this method was changed and each student was required to spend one month in the work of the basic course.⁸⁹ Recitations were held daily, and the students were carefully graded in their work.¹⁹

This school was discontinued in May, 1918, on account of the paucity of student officers available and was reopened in July.⁹⁰

The course covered a period of four weeks. If a student showed a lack of adaptability to this work, he was immediately returned to the basic course.^{19 91}

In the early days of the camp, Sanitary Company No. 1, which looked after all the sanitary work of the camp, was under the control of the director of the school.⁹²

The curriculum that finally developed and was found successful in imparting the greatest amount of such knowledge in the shortest possible time was divided into seven distinct heads:⁹¹

(a) Formal instruction by lectures and a specified course of reading. Rosenau's large textbook was used as the basis for reading, and an average of 50 pages was assigned daily. Each officer was required to make a written abstract of this work so that it was possible to ascertain that he had actually done the reading with fidelity and accuracy.

(b) Practical field work along special lines.

(c) Demonstrations of sanitary installments of military importance.

(d) Practical study, including the making of drawings of the more important sanitary appliances in the sanitary laboratory, together with a working knowledge of those of lesser importance.

(e) A short field course in map making and map drawing.

(f) The making of a sanitary survey of one entire section of the camp in the minutest detail, with a careful and comprehensive written report of the same.

(g) Oral quizzes were given by the individual instructors at frequent, but not specified, intervals on an average of three times a week. These were general and extended over a period of two hours. A formal written examination lasting, as a rule, about four hours, was given at the end of the second week, and a conjoint oral examination given by all the instructors together at the end of the third week. The written report of the final sanitary survey constituted the basis for a grade of the final week's work.

The course covered one month, and the student officer gave his entire time to this work, reporting at 7 o'clock in the morning and being dismissed at 5. The reading had to be done in the evening, as there was not sufficient time to finish it during the daytime. The reason for selecting a four weeks' course was that this seemed the longest period which should be spared at this particular time.

The practical field work along special lines was greatly emphasized. An idea of its scope may be obtained from the following summary: Each student was required to procure flies; to secure a suitable breeding chamber and to describe the different phases in the development of the fly, making notes and drawings of the various stages and developmental conditions. A careful study was made of the different breeding places of the fly and the different conditions under which they developed naturally. Several species of flies were studied, more particularly the common house fly, the bluebottle, and the biting stable fly. In the same way the mosquito was studied. The students were sent out

in groups to obtain mosquito larvæ, to determine the kind of mosquito from the larval form, and these were then put in suitable breeders and studied throughout the entire cycle of development. This was practicable with all except the last class, at which time it was too cold to carry on breeding experiments successfully. It is believed that in this way an actual practical knowledge of the life cycles of these two important insects was obtained which could not be obtained by either reading or lectures. Particular stress was laid upon finding the ova and larvæ of these insects in their natural habitats. The students followed the oiling squads for one whole day, thus becoming familiar with the methods of oiling pools and creeks.

A first-hand study of various sanitary installations of military importance was made under competent direction. An idea of the scope of this may be had by noting that visits were made to the city waterworks in Chattanooga and the entire system outlined and explained in detail by a sanitary engineer. In the same way several different chlorinating plants, the septic-tank disposal, and the bathing pool were carefully studied. Preceding the practical inspection of these, one or more lectures were given on the subjects and the students were thoroughly quizzed.

The field laboratory of sanitary appliances was made use of to the fullest degree. Each student was required to make careful drawings of 20 of the most important pieces of apparatus and to explain in detail the method of construction, the applicability, capacity, advantages, and disadvantages of each. Approximately, four half days were given to this work so that each officer who received this training should be in a position to intelligently handle a division or even larger unit as regards these matters. Special quizzes were held on the ground to ascertain the extent of their knowledge.

Four entire afternoons were given to practical instruction in map making and map drawing as well as in map reading. It is believed that this should be a part of every course of this nature if the student is not already familiar with it, since the reading of a contour map quickly and accurately is necessary to get an adequate grasp of the drainage of an area or the location for camp sites.

The fourth week of the course was devoted to making a sanitary survey. This sanitary survey was made with the utmost minuteness and served a triple purpose: First, it enabled the director to check up as to whether the student had examined and reported on every sanitary feature of the section in question. Second, this written report was immediately sent to the sanitary inspector of that particular district, and each point noted in the report was checked and commented upon by him and returned to the director who then personally investigated anything which required investigation, and sent a memorandum of these points to the commanding officer of the section. In this way it was possible to have a most minute inspection made once a month of the entire camp in addition to the regular inspections made by the director and his assistants. To insure that this written report was properly made, mimeographed directions were given each student.

The grading was based on a number of different features. Frequent oral quizzes were given at unexpected times and marks of these accurately

kept. The abstracts, the practical field work, the written examination, and the report of the sanitary surveys were given grade marks and from all of these the final grade was given the student.

Inasmuch as the mental attitude, adaptability, energy, and diplomacy count for a great deal in sanitary work, each student was given a rating along these lines and all of these grades together were used in basing the recommendation for assignment.

Starting with men who had had some sanitary experience—in other words, picked men—and giving them the basic course beforehand, in one month they could be given a very fair working knowledge of the subject provided they were of good average ability and were willing to work 12 to 14 hours daily. Each student had received at least one to two hours' practical instruction in sanitary inspections in the basic course before entering the advanced course. This course was very carefully planned, and it is believed that the course as outlined above is thoroughly sound and gives about as much as can be given in a month's time. It should be especially noted that the student's entire time was given to the subject and that he was not required to drill or to be present at retreat, etc., since in many cases the practical field work made it impossible to do this. The number of students should not exceed 20 or 25, since this course was designed in such a way as to require much personal teaching.

An outline for sanitary survey of Camp Greenleaf was made and given to each officer before he began his work. This outline was as follows:⁹¹

1. The territory assigned should be thoroughly studied on the map to obtain a general working knowledge of the terrain and buildings thereof.

2. The work should be mapped out systematically in such a way that no part can possibly escape.

3. The purposes of this survey are purely instructional, and to this end every point in regard to sanitation in the entire area should be accurately noted and commented on. In making this instructional survey, every point, whether good or bad, will be noted. For example, each and every mess hall, barracks, latrine, bathhouse, stable, storehouse, Young Men's Christian Association, and other civilian buildings will be inspected in every detail, and a notation of each detail will be made on the spot in the form of field notes. These field notes will be made according to a definite scheme, and the value of the survey will be estimated, in part, upon the sufficiency of this scheme. For example, in inspecting a mess hall, a note will be made of the conditions of the tables, floors, walls, kitchen utensils, serving tables, storerooms, presence of flies, and all other points which should properly be considered in the inspection of a mess hall. The handling of the food and the food itself will of course be noted. These field notes must be plainly legible and intelligently made out and must be handed in with the completed report.

4. A carefully made sketch of sufficient size to be intelligently read must be made of the territory, and on this the drainage shall be indicated and all sink holes, standing water, or low places where standing water might accumulate, together with the sufficiency or insufficiency of the ditching, must be noted. A comprehensive report as to possible improvements in drainage should accompany the report.

5. At least two inspections of the camp should be made in the evening and an accurate statement of the ventilation, especially in the civilian organizations and barracks should be made.

6. Inspection of the personnel: This should at least be carried to the point of noting accurately the cleanliness of all individuals connected with the serving of food.

7. A careful study of General Order No. 63 should precede the inspection, and wherever any part of this order is found not to be complied with, a specific note of the same should be made.

8. Test of a good sanitary report: A good sanitary report should enable the director to ascertain at once whether the storeroom of a given company in a given section is in proper condition; whether the drainage of a given area is adequate and if not, what is lacking; whether the Young Men's Christian Association in a certain section and the barracks are properly ventilated at night; whether the latrines are properly burned out or oiled; whether fly swatting in accordance with General Order No. 63 is being efficiently done; whether fly swatters and flytraps are present in proper numbers; whether mess kits are properly sterilized in accordance with general orders; whether handkerchiefs are properly sterilized; whether the amount of waste in a given company is excessive; whether the amount of food is sufficient and properly and cleanly prepared; whether sweeping is done and the floors scrubbed in accordance with orders; whether mosquitoes are present in any given stream, water barrel, etc. In short, the sanitary report is to cover every possible point which has any sanitary bearing. If the report fails to show any point of sanitation with a specific notation, not merely a general statement, it is in just that far inadequate and imperfect.

9. This sanitary inspection represents the test as to whether the student is capable of putting into practice what has been learned during the course in sanitation. Any student whose report is inadequate will not be recommended for sanitary assignment.

In connection with the instruction in this group, special mention should be made of the museum of sanitary apparatus completed under the direction of the camp sanitary officer. It consisted of 114 pieces of apparatus for field sanitation. Many of these were entirely new appliances, developed from a close study of existing apparatus and their deficiencies. This research feature, in addition to the museum's purpose of instruction, is worthy of special notice.⁹³ The purpose of this laboratory was twofold. First, it aimed to investigate the different forms of appliances for field sanitary use, to compare these with each other under different conditions, with a view to selecting those which best fulfilled their function, and also to standardize their construction, always bearing in mind that these appliances must be built from readily available materials. The second function was that of research in field sanitation, using the same methods as would be used in any laboratory whose work was of the same nature. It was desired to emphasize this function of the laboratory, since it had been productive of a number of new appliances, some of which were of entirely different design and principle from anything hitherto published. The justification of this research work is evident, when we consider that almost nothing of this sort had been done in this country, or, so far as can be learned, in any other country. Intensive work on the construction of the various forms of apparatus was begun during the latter week in July. Particular stress should be laid upon the fact that all were built without expert workmen, using only artisans found in the various companies. No special materials were available and a large proportion of the work was done with brick, wood, and such materials as could be found in the junk pile at the reclamation department.⁹³

SCHEDULE FOR FIRST COURSE IN SANITATION⁹¹

FIRST WEEK

Tuesday:

Starting of fly breeding; starting of mosquito breeding.

8 to 9 a. m.—Lecture ("Disposal of wastes in connection with flies." Major Williamson).

Field work—Demonstration of pertinent apparatus.

Reading—Rosenau: Preventive Medicine and Hygiene (Chap. IV, pp. 201–208 ("General considerations")); Chap. IV, pp. 208–218 ("Insecticides"); Chap. IV, pp. 247–261 ("Flies")).

General Order 63, Headquarters, Camp Greenleaf, XV and XVI.

Wednesday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Field disposal of urine, feces, and garbage." Major Williamson).

Field work—Demonstration of pertinent apparatus. Field study of ditching, oiling, spraying, and weed cutting.

Reading—Rosenau, as above (Chap. II, pp. 83–134 ("Diseases spread by alvine discharges")).

General Order 63, Headquarters Camp Greenleaf, XIII and XIV.

Thursday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Communicable intestinal diseases." Major Eggers).

Field work—Hookworm field work.

Reading—Rosenau, as above (Chap. IV, pp. 221–246 ("Mosquitoes")).

General Order 63, Headquarters Camp Greenleaf, XVII.

Friday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Hookworm and its management." Major Tenney).

Field work—Map work, with especial reference to sanitation.

Reading—Rosenau, as above (Chap. III, pp. 134–199 ("Diseases spread by respiratory discharges")).

General Order 63, Headquarters Camp Greenleaf, X.

Saturday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Mosquito-borne diseases." Major Tenney).

Field Work—Map work.

Reading—Rosenau, as above (Chap. IV, pp. 261–301 ("Miscellaneous parasites")).

Monday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Lice, fleas, and miscellaneous parasites, and diseases associated with them." Major Tenney).

Reading—"Munson on measles epidemic." *The Military Surgeon*, June, 1917, et seq.

SECOND WEEK

Tuesday:

Inspection of fly breeding; inspection of mosquito breeding.

8 to 9 a. m.—Lecture ("Clinical aspects of respiratory diseases." Major Williamson).

Field work—Map work.

Reading—"Communicable diseases at Fort Riley and Camp Funston." *The Military Surgeon*, July, 1918.

Wednesday:

Inspection of fly breeding; inspection of mosquito breeding.

Lecture—"Prevention of communicable respiratory diseases." Major Eggers).

Field work—Map work.

Reading—Rosenau, as above (Chap. VII, pp. 362–388 ("General considerations")).

Thursday:

Inspection of fly breeding; inspection of mosquito breeding.

Lecture—"Food diseases." Captain Wilmot).

Field work—Cooking devices, sanitary laboratory.

Reading—Rosenau, as above (Chap. XII, pp. 1099–1166 ("Disinfection")).

Friday:

Inspection of fly breeding; inspection of mosquito breeding.

Lecture—"Personal hygiene." Major Tenney).

Field work—Chlorination plant.

Reading—Ashburn, Ford, Lelean, on ("Personal hygiene").

Saturday:

Inspection of fly breeding; inspection of mosquito breeding.

Lecture—"Water supplies." Major Rich.

Field work—Inspection of water supply and water shed.

Reading—Rosenau (Chap. VI, pp. 789-821 ("General considerations")); pp. 866-878 ("Interpretation of water analysis"); pp. 878-953 ("Purification")).

Monday:

Examinations.

Reading—Rosenau, as above (Chap. IX, pp. 987-1033 ("Vital statistics")).

THIRD WEEK

Tuesday:

Lecture—"Sanitary survey of a small town." Captain Wilmot.)

Field work—Vital statistics.

Reading—Sanitary orders, in Ford's Administration. General study of General Order 63, Headquarters Camp Greenleaf.

Wednesday:

Lecture on the United States Public Health Service. Doctor Knight.

Field work—Lecture on the United States Public Health Service.

Reading—"Duties of sanitary inspection." Ford's Administration).

Thursday:

Lecture—"Relations of the laboratory to the sanitary inspector." Major Eggers).

Reading—Article on sanitation, to be selected by student and approved by instructor, and abstracted by former.

Field work—Time to be used to fill in any previous lapses in schedule.

Friday:

Lecture—"Duties of the sanitary inspector." Major Tenney).

Inspection of camp site and report on same.

Saturday:

Lecture—"Sewage disposal." Major Rich).

Remaining time to be used as on Wednesday, third week.

Monday: Demonstration of remaining sanitary appliances.

FOURTH WEEK

Entire week devoted to sanitary inspection of different sections of Camp Greenleaf.
Saturday: Final examination (oral).

SCHOOL FOR SANITARY ENGINEERS

The school for sanitary engineers, which was attached, as a subschool, to the School of Military Hygiene, was established in compliance with the following letter of instructions:⁹⁴

JANUARY 7, 1918.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: School for sanitary engineers, officers of the Sanitary Corps.

1. A school for sanitary engineer officers of the Sanitary Corps will be established as part of the general scheme of instruction carried out in the Medical Officers' Training Camp, Fort Oglethorpe, Ga.

The student officers are all to be sanitary engineers.

It is understood that many of them will later take charge of the divisional sanitary detachments, thereby requiring rather broad medico-military knowledge.

2. The purpose of this school is to conduct the training of those officers of the Sanitary Corps along military lines, from the military viewpoint, and in the military environment; and coincidentally to develop them physically and train them in subjects which they should know under the conditions under which they would practice their specialty including organization, regulations, paper work, applied hygiene and sanitation, handling of enlisted men, and general functions of officers.

3. About 20 graduate sanitary engineers of the Sanitary Corps are required monthly. Classes should be arranged on a basis of a course extending over not less than two months.

4. The senior instructor for this school detailed by this office on the staff of instructors of the training camp will, under the commandant thereof, be in direct charge of the course.

In addition to his educational duties, he will continuously investigate the qualifications and suitability for service of student officers under instruction.

5. As far as possible, any local problem of a sanitary nature will be utilized as part of the subjects of instruction.

6. The school for sanitary engineers will affiliate with the School of Applied Hygiene and Sanitation at your camp.

It will also, to the extent deemed desirable by you, affiliate with the school for laboratory men which it is proposed to establish at your camp.

7. The general professional instruction to be given will especially relate to all measures intended for the preservation of health of troops and their protection against disease.

Detailed information as to any special instruction desired on sanitary engineering, etc., will be furnished by the engineering division, this office.

8. The above course in general training and applied hygiene and sanitation will cover a minimum of two months.

9. Officers of the sanitary engineer division, Sanitary Corps, under training in this course will be organized as a special company, will be quartered and subsisted in the medical officers' training camp, and will be subjected to its discipline at all times.

10. Hours of instruction will be arranged by the commandant of the training camp.

11. The schedule for the first month is as follows:^a

* * * * * *

13. A number of enlisted men, to work under the division of field hygiene, will be kept at your camp under instruction therefor. The number will be later announced.

All should be given such part of the basic course for enlisted men at your camp as might be of advantage to them in such service. The scope of their special training in sanitation will be prescribed by you.

14. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON, *Colonel, Medical Corps.*

The sanitary engineering officers composing the School of Sanitary Engineering were relieved from duty with the School of Military Hygiene and transferred to the 7th Battalion, medical officers' training camp.⁹⁵ A large room in one of the officers' buildings near the battalion headquarters was assigned to the school as office and work and recitation room. The general program to which the engineer student officers conformed was as follows:⁹⁵ They lived in the student officer barracks, having a place in one of the companies, and took a full part in the regular barrack-room life. They took part in the morning drills and setting-up exercises. They attended the lectures and did the paper work of the basic course, excepting when the basic course work diverged too far from the field of sanitary engineering, when they were excused from this requirement by their instructors. They received special instruction in work directly related to the service of the sanitary engineer in Army camps. The special instruction in sanitary engineering, in general, occupied the afternoons and evenings. Its chief purpose was to focus the student's knowledge of practical sanitation upon the sanitary problems of camp life. For the accomplishment of this purpose it was necessary to spend a large amount of time in the field, but work in the field was always supplemented by conferences, readings, round-table discussions, quizzes, and the preparation of reports

^a See schedule, pp. 78, 79.

in quarters. Among the particular problems of camp sanitation which were covered in this way, the following may be listed as the most important:⁹⁵

Camp diseases, particularly those definitely related to the physical environment.—Causes, prevalence, and methods of prevention. The basic course lectures and quizzes in this subject were supplemented by readings and round-table discussions.

Camps and camp sites, general and sanitary requirements.—Topography, soil, exposure, area, arrangement; shelter, tentage, barracks, etc.

Camps and camp sites, improvement and control.—Drainage; mosquito extermination; fly control; ventilation, heating, plumbing, screening; sanitary inspections; policing.

Water supply.—Quantity required under different conditions; quality; purification, particularly by means available in field service; carriages and distribution.

Waste disposal.—Kitchen wastes—garbage and slops—burning, burial, feeding to swine, etc. Excretal wastes—sewerage and sewage disposal; latrines and trenches. Stable manure and litter. Camp rubbish.

A total of 110 officers received instruction in this school. The school closed December 17, 1918.⁹⁶

SCHOOL OF EPIDEMIOLOGY

The School of Epidemiology, which was intended to form part of the training in Medical Department sanitation, was established so shortly before the signing of the armistice that its accomplishments were necessarily very limited. All that need be recorded concerning it, therefore, is the program promulgated for its operation:⁹⁷

PLAN OF INSTRUCTION, SCHOOL OF EPIDEMIOLOGY

The training in the school was largely practical. In the first week practical instruction was given in making inspections for contagious diseases. Clinics and demonstrations on contagious diseases and their handling were held. Detailed schedule follows:

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
7 to 9	Inspection	Inspection	Inspection	Inspection	Inspection	Inspection	Inspection
9 to 11	Lecture: General plan of methods	Clinic: Measles, ward N, hospital	Clinic: Mumps, ward U, hospital	Clinic: Scarlet fever, etc., ward I, hospital	Review, quiz, office headquarters school	Conference, office headquarters school	
1.30 to 3	Inspection isolation camps, 15th Battalion, Company C	General conference, school headquarters	Demonstration of handling of contagious diseases in hospital ward I	Demonstrations, records, etc., school headquarters	General conference, school headquarters		
3 to 4.30	Inspection	Inspection	Inspection	Inspection	Inspection	Inspection	Inspection

At the end of the first week such officers as did not show evidence of adaptability to the work were dropped. Subsequent instruction was almost entirely practical and consisted of inspections for contagious diseases, demonstrations of the cases remaining in isolation

camp, with a consideration of the necessities of each camp and the method of solving camp problems, and assignment as assistant to the various camp directors. As fast as an officer qualified as assistant he replaced one of the officers in charge who might be then available for assignment.

Twice each week, on Tuesday and Friday afternoons, a general conference was held of all officers assigned to the school. At this conference practical problems arising in the various groups were brought up and discussed, informal lectures on various phases of the work were given, and such current literature as was pertinent to the school was reviewed.

The time necessary to train officers for assignment as epidemiologists varied, but on the average one month was necessary.

SCHOOL OF MILITARY MEDICINE

In 1918 two schools covering work which may be classified under this head were conducted. One was for the instruction of officers to be detailed later on cardiovascular boards and the other for the instruction of officers in lung examinations. They were separate and distinct and will be considered separately up to the time of their consolidation.⁹²

SCHOOL FOR EXAMINATION OF THE LUNGS

This was entirely clinical, and officers detailed to this course were given special instruction in the recognition of the different pathological lesions in the lungs.⁹⁸ This work was considered only as an adjunct to their basic course, and for some months no special time was allotted to these classes. In March, 1918, the number of students increased greatly, and more room for the classes at the hospital was required.⁹⁹ This school encountered the same difficulties that were present with all courses of instruction during the war, in that many officers had to be detailed elsewhere before completing the course.¹⁰⁰

THE CARDIOVASCULAR SCHOOL

This school was organized January 20, 1918, beginning with a small class obtained from among those in the student companies who were desirous of taking up this work, and who had sufficient professional qualifications to master it in the short time allowed. The course outlined at first was as follows:¹⁰¹

During the forenoon: Quizzes on anatomy, physiology, and diagnosis; examination of ambulant cases, under supervision of instructors; pathologic demonstrations and lectures; review of the newer literature.

Afternoon: Bedside instruction in the wards of the hospital.

Each student was assigned a patient and was required to make a complete general medical examination, including blood, urine, sputum, and, in appropriate cases, analysis of the spinal fluid, and determination of the intestinal flora.¹⁰² The first class consisted of only 12 students, but, by March 1 that number had increased to 27. As the course developed, instruction was given in the interpretation of the polygraph in normal and abnormal cases. The ward examinations were systematized, to provide for a most thorough and careful examination of each case under discussion. The Roentgenological study of chest lesions was covered in conjunction with the School of Military Roentgenology (q. v.).¹⁰¹

These two schools were combined in April, 1918, and became the School of Internal Medicine, which designation was later changed to the School of Military Medicine.¹⁰³

In the assignment of students to this school, the same methods followed in other schools obtained. Most of the students were taken from those reserved by the Surgeon General's Office for this class of work. After one month's military instruction, which was afterwards reduced to two weeks, the entire time of the student was devoted to his special training. Unfortunately, the demands of the service were so great that very few of these students were allowed to remain until the completion of the course. This greatly curtailed the usefulness of the school.

In July, 1918, the instruction at the school was widened to include instruction in general medicine and gastroenterology, in addition to the instruction in cardiovascular and lung diseases.¹⁰⁴

The work increased greatly during the last half of 1918, as may be seen from the numerical list of student officers for the month of September.¹⁰⁵

a. Total number in school during September.....	114
b. Total number carried over from August.....	32
c. Total number reported for instruction during September.....	82
d. Total number found, after preliminary work, not to be qualified.....	12
e. Total number ordered away while in course.....	9
f. Total number completing course during September.....	4
g. Total number carried over into October.....	89

During October, 1918, work in this school came to a standstill, owing to the occurrence of the severe influenza epidemic. All of the instructors and many student officers were made available for the treatment of the large number of patients, and many student officers were ordered to other camps for the same duty. The school was formally closed December 23, 1918.¹⁰⁶

SCHOOL OF MILITARY PSYCHOLOGY

The establishment of the School of Military Psychology was authorized by the Secretary of War in January, 1918, in reply to a letter from the Surgeon General to The Adjutant General, December 7, 1917, concerning the extension of psychological examining.¹⁰⁷ The constitution of the school was outlined in a letter from the Surgeon General to the commandant of Camp Greenleaf in January, 1918.¹⁰⁸

JANUARY 5, 1918.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: School in Military Psychology.

1. A school for military psychologists will be established, as a special course for selected student officers, as part of the general scheme of instruction carried out in the Medical Officers' Training Camp at Fort Oglethorpe, Ga.

2. The purpose of this school is to conduct training of psychologists along military lines, from the military viewpoint, and in the military environment; and coincidentally to develop its officers physically and train them in subjects which they should know under the conditions in which they would practice their specialty, including organization, regulations, paper work, relations with enlisted men, and their general functions as officers.

3. About 50 psychologists will be required monthly. Classes under instruction should be arranged for on the basis of a course lasting two months.

4. The senior instructor in psychology detailed by this office on the staff of instructors of the training camp will, under the supervision of the commandant thereof, be in direct charge of the course.

In addition to his educational duties, he will continuously investigate the qualifications and suitability of officers and enlisted men under general instruction relative to detail as psychologists.

5. The routine work of psychologists at your camp will, as far as possible, be demonstrated and utilized as part of the subjects of instruction.

6. The general instruction to be given will relate to the principles of psychological examination.

Detailed information as to the general nature and scope of the work to be done will be furnished by the psychology section of this office.

The course of instruction in psychology, based thereon, will be prescribed by the commandant of the training camp after conference with the instructor in psychology.

7. The course in general training and psychology will cover a minimum of two months. In addition to instruction in other subjects, the course in psychology will comprise a total of 167 hours.

8. Officers under training as specialists in military psychology will be quartered and subsisted in the medical officers' training camp and subject to its discipline at all times.

9. They will be organized as a special company. Hours of instruction in military psychology will be arranged by the commandant of the training camp.

10. The schedule for the first month is as follows: ^b

* * * * *

PSYCHOLOGICAL INSTRUCTION

	Hours
Organization and administration of psychological examination.....	6
Paper work, relating to psychological examining.....	6
Group examining, practice.....	10
Scoring, organization and methods, checking, filing, etc.....	12
Individual examining, practice.....	14
Statistical method.....	10

11. The schedule for the second month is as follows: ^b

* * * * *

12. About 25 to 50 selected enlisted men, to work under the division of psychology, will be kept at your camp under instruction therefor.

Some of them will be sent with a view to being tried out as to their fitness for appointment as officers of the Sanitary Corps under the division of psychology.

All should be given such part of the basic course for enlisted men, including the physical, military, and professional, as might be of advantage to them in their special service with psychologists.

Their further special training under the psychology division will be outlined by the representative of that division on your staff of instructors subject to your approval. They should be organized as a separate company under officers of the Sanitary Corps serving under the division of psychology.

13. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON, Colonel, Medical Corps.

The course was designed to cover, in a minimum of two months, 365 instruction hours.¹⁰⁹ It was provided that about 50 officers of the Sanitary Corps and 25 to 50 enlisted men, selected from psychologists already in service, or gained through voluntary inductions into the Medical Department, should be trained

^b See pp. 78, 79.

each month, until the authorized numbers should be secured. Provision was also made for the organization of psychologists into 2 companies, 1 commissioned and 1 enlisted. It was permitted that on the basis of abilities and qualities exhibited in training, about 50 men from the total enlisted group should be recommended for appointment as commissioned officers, 62 as sergeants, and 62 as corporals.

On February 4, 1918, officers and enlisted men detailed for instruction began to arrive. No barracks for the use of additional companies were at that time available, so that until a sufficient number of officers to form a company of 25 to 30 should arrive, commissioned psychologists were assigned to Companies 13, 14, 15, and 16, which were already formed of officers in the Medical Department. Similarly, until facilities and adequate personnel for the formation of a company of enlisted psychologists were obtained, these men were assigned to the Camp Greenleaf infirmary detachment. On February 8, 22 commissioned psychologists then in camp, together with certain other officers of the Sanitary and Veterinary Corps, were combined in Company 15. Until February 16, when the psychological officers of this company became Company 28, 7th Battalion, medical officers' training camp, and moved to a section of the camp where facilities for special training were available, commissioned psychologists received the same training as that given regularly to medical officers.¹⁰⁹

On March 7 the enlisted psychologists, then numbering 49, were moved from the infirmary to the tents of the recruit section of the division of hospitals and sanitary trains, 14th Battalion, and formed Company F of that battalion. In addition to their military training, special psychological training for these soldiers was begun at that time. On April 20 Company F became psychological Company No. 1, and, together with the commissioned psychologists of Company 28, was moved to more commodious quarters, formerly occupied by base and field hospitals. On June 20 a building specially constructed for psychological examining was completed and both groups of psychologists were consolidated and quartered, the officers in the psychological building itself and the enlisted men in the near-by barracks of the motor sanitary units in Camp Greenleaf annex. Formal instruction in military psychology was discontinued August 1, 1918.¹⁰⁹

The psychological instruction to be given in this school was outlined in a syllabus prepared under the direction of the Surgeon General:¹¹⁰

ORGANIZATION AND ADMINISTRATION OF PSYCHOLOGICAL EXAMINING

(First month, six hours; lectures by senior instructor)

First lecture: History of organization; general purposes; present official status; general relations to Medical Department and to psychiatric work; to personnel department; to line organizations.

Second lecture: Summary of previous camp work. General outline of system of examining in camp; the building; the course of examining. The alpha examination; the beta examination; the individual examinations. Method of calling and handling examinees. Scoring and reporting.

Third lecture: The psychological personnel and their tasks. Duty of the chief examiner; the assistant examiners; the clinical psychologists; the sergeants and corporals; the copy clerks; the orderlies. Efficiency records and weekly reports.

Fourth lecture: The alpha examination in detail. First trial and revision; the Washington revision. Reasons for changing particular tests. Results thus obtained in camps.

Fifth lecture: The beta examination in detail. Sources of material; purposes; general principles of construction and graduation. The individual examination in detail. Principles of formation, sources, results of application.

Sixth lecture: Model lecture for bringing out the main points to be emphasized in conferences with company and other commanders. Information which may and information which may not be given the general public.

PAPER WORK RELATING TO PSYCHOLOGICAL EXAMINING

(First month, 6 hours; lectures and problems)

This course is to be conducted in connection with the courses given all medical officers in paper work relating to the Medical Department and paper work relating to the Quartermaster's Department. It will relate to problems peculiar to the work in psychological examining such as channels, reports and correspondence, numbering and filing systems, use of the Scott rating scale, and memoranda, vouchers, transfers, etc. In practice students will be required to compose letters and memoranda, making reports, and filling out vouchers, etc., such as most frequently used in work of psychological examining.

GROUP EXAMINING PRACTICE

(First month, 10 hours; second month, 40 hours)

Students in military psychology, and other officers in training, will first be examined by instructors in order that the general character of the alpha examination shall become familiar to students. Thereafter, coaching and recitation in giving the alpha examination will be required of all students under criticism, as to voice, emphasis, technique of handling group, etc. Instruction and practice in giving and scoring the literacy test and the beta examination will follow. Students serve as examiners and as orderlies until complete uniformity is obtained.

SCORING ORGANIZATION AND METHODS

(First month, 12 hours; practice and conferences)

Systems of scoring previously used in the camps will be tried out and improvements attempted. Students will be required to hold, for a limited time, the following positions: In general charge, in charge of copying, of scoring, of table, and as clerk. Experimental determination of scoring system which shall accompany maximum of work and minimum of errors in a given time.

INDIVIDUAL EXAMINING PRACTICE

(First month, 14 hours; second month, 36 hours)

Under direction and with criticism, practice with the Stanford revision (complete form), abbreviated Stanford for illiterates, the point scale, the performance scales, the test for suspected psychotics. Qualitative types of response. Separate scores, variability. Scoring and report to medical officer.

STATISTICAL METHODS AND PRACTICE

(First month, 10 hours; second month, 10 hours)

Lectures, recitation, computations, and reports. Frequency distributions, tables, and graphs. The frequency surface and ogive. Measures of variability. The determination of percentile scores by smoothing the ogive. The absolute value of scores by the theorem of normal distribution. Correlation: Product-moments; rank differences; unlike signs. Labor-saving devices. Formulation, validation, graduation, and integration of new tests and test series.

The greater portion of the work will consist in actual computation and report upon assigned problems, using the material collected in the alpha, beta, and individual test series. Readings will be assigned in Rugg's *Statistical Methods Applied to Education*, and in Thorndike's *introduction to Mental and Social Measurements*.

MENTAL INCOMPETENTS

(Second month, 10 hours; lectures, reports, and, if feasible, clinics)

Lectures on insanity and feeble-mindedness by psychological instructors and medical authorities. Assigned readings in White's *Outlines of Psychiatry* and Tredgold's *Mental Deficiency*. Recitations as time permits.

SERVICE ORGANIZATIONS

(Second month, 2 hours; lectures to be arranged)

MALINGERING

(Second month, 6 hours; lectures and clinics, assigned readings, and reports)

Lectures by psychiatrists and by psychological instructors. Assigned readings in Jones and Llewellyn's *Malingering* and other works. Demonstrations of methods for the detection of malingering.

REPORTING RESULTS

(Second month, 2 hours; conferences)

Summary of previous methods and recommending system for future reporting.

The general instruction for commissioned officers was given chiefly by battalion and company commanders and by the corps of medical instructors of the medical officers' training camp.¹⁰⁹ Until the McLean auditorium was constructed the lecture courses were given in the annex of the Young Men's Christian Association near camp headquarters.

The general instruction for enlisted psychologists followed as closely as possible that given to the officers, save that in certain cases, such as *Army Regulations and Manual for the Medical Department*, abbreviations and substitutes were made and parts of Mason's *Handbook for the Sanitary Troops* were used as a text. This instruction was conducted by officers of the school.¹⁰⁹

The first lectures were given in a lecture room formed by throwing together rooms in former officers' quarters; later, mess halls, and still later, a lecturer's table in the open air, before an amphitheater under the trees, were used, until in June a special psychological building became available.¹⁰⁹ This building was located centrally in Camp Greenleaf, near the headquarters of the division of hospitals and sanitary trains. It was two stories, 120 by 30 feet. The lower floor at the eastern end of the building was a large room, with benches and lap wall boards for the use of about 200 men in the alpha group examination. At the opposite end of the building was a similar room, fitted with benches, tables, shelves, and special lighting arrangements for the beta group examination, for about 100 illiterates and foreigners. Between these two rooms was a hallway, with a drinking fountain and supply room, which was used also as a library and fitted with shelves and counter. Above the beta room was a well-lighted scoring room, provided with tables, chairs, and shelves and sufficiently large to accommodate 50 clerks and scorers. The remainder of the upper floor consisted of 5 rooms for individual examining, 2 offices, a record

room, a supply room, 2 lavatories, and 4 rooms which served as quarters for the commissioned examining staff. For use and instruction, necessary books, guides, blanks, office, and examining apparatus and materials were provided. Blackboards for the two large rooms were purchased from battalion and company funds.

Psychological training, outlined above, was supplemented in several ways.¹⁰⁹ A course of four lectures on the political and religious creeds commonly held by conscientious objectors was given. Upon three occasions, lectures were given by personnel officers and supervisors, and practical experience in personnel interviewing was secured by student officers and men at recruit depot, Fort Oglethorpe, and at Camp Forrest. Special lectures on the psychological aspects of reconstruction were given by officers from the reconstruction division of the Surgeon General's Office. Considerable practical experience in actual examining, both of groups and of individuals, was also given to students. The instructor in psychology twice had the opportunity of giving general lectures on the nature and purpose of psychological examining to the medical student officers, as a part of their scheduled instruction. Psychological instruction was conducted almost exclusively by officers of the school.

The lectures on organization and administration of psychological examining covered the following subtopics: History; purposes and official status of the work; relations to Medical Department (especially to neuropsychiatry); relations to personnel work; relation to line organizations; summary of camp results; outline of system of examining; scoring; filing; reporting; camp psychological personnel and their duties; construction, revision, and results of the alpha, beta, and performance scale examinations.¹⁰⁹ The course in paper work relating to psychological examining consisted of lectures on the form of letters, indorsements, memoranda, telegrams, and psychological reports, on rules as to channels, titles, expressions, and as to the making of vouchers, receipts, and other papers relating to supplies. Practical problems relating to paper work were set and their solutions criticized. Moss's Army Paper Work was used as a partial text.

In the alpha examining practice, the student, after taking the examination, scoring papers, listening several times to the examination as given by a practiced examiner, and in some cases repeating it in unison with the group, was required to give the examination individually under criticism. When uniformity and accuracy in voice, emphasis, and speed were obtained, students were given practice with groups in actual examination, in order to perfect technique.

The practice in beta examining was similarly conducted. Students acted at various times as examiner and as chief orderly, until precision and uniformity of action and gesture were secured.

Lectures and practical demonstrations of the organization and methods of scoring group examinations were given. Methods to secure accuracy and speed of scoring were specially emphasized. Students were required to score papers during a period long enough to make all details of scoring and grading perfectly familiar.

Practice in individual examining consisted in lectures, study, and recitations on the structure and rules of the Yerkes-Bridges point scale, the Stanford-

Binet age scale, and the performance scale examinations. Students were required to write out brief "pocket rules" for giving and scoring the tests. When the general nature, principles, and detailed rules of the examinations were clearly in mind, students were grouped in pairs each member of which gave his partner the examinations. Long practice in accurate scoring and regarding actual papers, discussions of typical cases of "border-line" intelligence, of foreigners and illiterates, of the feeble-minded, of the insane, and of malingerers, interpretation of "scatter" and of atypical reactions, and of the basis of recommendations as dependent upon mental age, educational status, personal, family, economic, and social history, were made features of the instruction before tests on actual cases were made.

The courses in statistical method comprised, in part, five or more lectures on graphic representations, measurement of central tendencies and of variability, and of correlations and their interpretation. The greater part of the work, however, consisted in practical computations based on data collected in the camp. Assigned readings were made in Rugg's Statistical Methods and in Thorndike's Mental and Social Measurements. In connection with the course in statistics, data bearing on the revision and improvement of methods, the assignment of grades, and the equalization of scores on various scales were obtained and reported to the division of psychology of the Surgeon General's Office.

The courses in mental incompetency and in malingering were given in close connection with that on individual examining. In the former course, the lectures were supplemented by readings in Tredgold's Mental Deficiency and in White's Outlines of Psychiatry, and in the latter course, by Jones and Llewellyn's Malingering. In both, however, references were continually made to actual cases handled by the lectures, in order to make concrete the generalizations and typical pictures.

The following is a typical daily program of instruction:¹⁰⁹

5:45 a. m.	First call.
6 a. m.	Reveille.
6.30 a. m.	Mess.
7 to 9.15 a. m.	Setting-up exercises and drill.
9.30 to 11.30 a. m.	Military lectures (commissioned group). Psychological lectures (enlisted group).
12 m.	Mess.
1 to 2 p. m.	Quiz (commissioned group). Military lectures (enlisted group).
2 to 4.	Psychological lectures or practice, or drill (enlisted group).
5.	Retreat.
5.30.	Mess.
6 to 7.	Study (commissioned group). Singing and quiz (enlisted group).
9.30.	Taps.

Inspection and military or psychological lectures composed the program for Saturday mornings.

Psychologists upon arrival in camp were given alpha examination and filled out a modified officer's qualification card. On this card were listed student's topics of specialization and publication and their amount and variety of psychological and applied psychological training, as well as their preferences as to psychological duties. Their abilities in the practice courses were continually

estimated and recorded by the instructors in charge; the officers' military grades were reported weekly by the company commander to the battalion commander, who revised them. In lecture courses, grades were determined by recitations and final examinations. Recommendations as to promotion and assignment of commissioned psychologists were made by a board of examiners.

For enlisted men, the data on the qualification cards, the report of the company commander as to military records, and the marks obtained in the training course were similarly secured. A written examination on general psychological topics and an oral examination furnished a further basis of recommendation by a board composed of officers of the school.

During the period in which formal instruction was given in the school, psychological examinations were made and reports were submitted on the various activities.¹⁰⁹

In July, 1918, it was directed that early examination of all organizations in Camp Greenleaf be made.¹⁰⁹

A complete critical and constructive report on the revision of the psychological examinations and examiner's guide, as well as 10 special reports dealing with psychological methods, the equation of grades on various scales, and the examination of conscientious objectors were made from this school.¹⁰⁹

Sixty-eight officers and two hundred and twenty-six enlisted men received instruction in this school.¹⁰⁹

In the period from August 7, 1918, to October 1, 1918, very little instructional work was undertaken, as the entire time was occupied with the examination of incoming drafts, the preparation of distributions, and the summarizing of examinations.¹¹¹ Although no special classes were held, much practical instruction in group and individual examining and scoring was given, incident to the examining. The number of men in the school was small. From October 1 to 13, the influenza epidemic was at its height in this camp. As the psychology building was used as an infirmary for influenza suspects, hardly any examinations were given. Instruction was also necessarily limited. From October 14 to November 9 definite classes in psychological examining were held as a considerable number of enlisted men and officers had reported for the new school of psychology. Instruction during that period was given in lectures as follows:¹¹¹ (a) Organization and administration of psychological examining; (b) statistics; (c) group examining practice; (d) scoring filing; individual examining, lectures, and practice. During this period numerous psychological examinations were given, particularly at Camp Forrest. In the week from November 11 to 16 a course of instruction on personnel work, taking the entire time of the men for three days, was given by The Adjutant General's Department, committee on classification of personnel. In the evening an officer from the Surgeon General's Office gave lectures on reconstruction and reeducational work. The remainder of the week was spent in practice in personnel work (interview, tabbing, etc.). From November 16 to December 7 instruction was given in reconstruction work and individual examining, the mimeographed revised Manual for the Medical Department, chapter 2, "Military hospital organization and administration," being used as the basis of instruction. Other reconstruction literature and the circular "Army Mental

Tests" were also studied. The entire week of December 9 to 14 was spent in a special course in trade testing. The instruction consisted of lectures on oral and picture tests, together with examining practice. During the two weeks from December 16 to 28 the time was chiefly spent in athletic exercise and drill. Several lectures on deception tests were given and some experiments tried.

On December 30 and 31 orders were issued from headquarters, Camp Greenleaf, demobilizing practically all of Camp Greenleaf. The psychological detachment was included in these orders, and in the period from December 31, 1918, to January 9, 1919, practically all the men were discharged or transferred for discharge, thus bringing the school to a close. Twenty-one officers and fifty-five enlisted men attended this second school.¹¹¹

SCHOOL OF MILITARY ORTHOPEDIC SURGERY

The first step in the development of the School of Military Orthopedic Surgery was the inauguration, in the early days of the camp, November, 1917, of the School of Applied Surgical Mechanics, the purpose of which was to teach as many officers as possible the principles of the care of gunshot wounds and the splinting of fractures in the military service.^{19 c} Most of the students who attended the school at its inception were officers reserved for orthopedic service and those detailed for duty with evacuation hospitals.⁹² In this school a great deal of work in the preparation of mechanical appliances was done, and a large number of plaster and gelatin casts of different parts of the body, to illustrate military surgical work, were made. These casts formed the nucleus of a museum of casts to be used in the teaching of military surgery.^{95 112}

Another phase of orthopedic work was covered in the School for Care of Feet, in which were taught elementary orthopedics, including the fitting of shoes and the treatment of minor injuries of the foot.^{8 113} This school also conducted a gymnastic course for the reclamation of men who otherwise would have been discharged on account of flat foot. All student officers were required to attend this course.¹¹³

In December, 1917, the Surgeon General outlined a plan for the organization of the School of Military Orthopedics.¹¹⁴ In accordance with these instructions, the two schools already in operation were combined with a new course in didactic and clinical work, thus forming the School of Military Orthopedic Surgery,¹¹⁵ which continued to operate as such until December 24, 1918.¹¹⁶ The work of the newly organized school fell under three categories:^{113 115 117 118}

Course A.—The soldier's foot. To teach the care of the feet, shoe fitting, normal anatomy, and the common deformities of the soldier's foot.

Course B.—Applied mechanics. To teach the mechanics of fracture dressings and appliances.

Course C.—Didactic and clinical. To conduct the didactic and clinical work of the school.

Student officers taking the first two courses were also in the basic course of the camp, but when they advanced to the third course their time was devoted exclusively to professional work.^{113 118}

This professional work was outlined as follows:¹¹⁹

* This school afterwards became part of the School of Military Surgery (q. v.).

1. Subjects taught:

- (a) Anatomy (30 hours).
- (b) Pathology of bones (6 hours).
- (c) Orthopedic surgery, didactic (24 hours).
- (d) Orthopedic surgery, clinical (48 hours).
- (e) Fractures (6 hours).
- (f) Minor foot ailments in military service (6 hours).
- (g) Carrel-Dakin method (3 hours).
- (h) Military hospital (6 hours).
- (i) Ligations and amputations (3 hours).
- (j) Nerve surgery (3 hours).
- (k) X ray (6 hours).
- (l) Neurology (3 hours).
- (m) "Literature Club" class (44 hours).

This consisted of the preparation of abstracts of the recent orthopedic bone and joint literature, their presentation to the class, and discussion thereon.

2. Objects of course: In the absence of definite instructions the director of the course had the following objects in mind:

- (a) The making of intelligent orthopedic assistants.
- (b) Giving a thorough groundwork for future training in orthopedic surgery.
- (c) Turning out medical officers sufficiently well equipped to become orthopedists in various types of field hospitals and, in some instances, base hospitals.

3. Duration of course, four weeks.

4. Total number of hours in course, 188.

This school continued in a rather unsatisfactory way until July, 1918, when it was reorganized and placed on a better footing. During this time small classes ranging from 15 to 25 officers took the course.^{120 121 122 123} After the reorganization instruction was given to officers reserved for orthopedic surgery and other officers desirous of taking this course. Before being assigned to the orthopedic school each officer must have completed at least two weeks basic instruction, though at first one month's basic course was prescribed.^{118 6}

The following letter from the Surgeon General's Office outlined the policy to be followed with the officers assigned to this school:¹²⁴

JULY 12, 1918.

From: The Surgeon General, United States Army.

To: The Commandant, Medical Officers' Training Camp, Camp Greenleaf, Ga.

Subject: Student officers' division of orthopedic surgery.

1. In order to prevent confusion and to expedite the handling of orthopedic personnel, the following procedure is recommended:

I. Student officers will be assigned to the camp in the usual way, in order that they may receive military training prior to assignment to special courses. This training should preferably be four weeks or longer.

II. Lists of student officers so ordered will be forwarded by this office to the commandant, and a second list forwarded the director of the School of Orthopedic Surgery, through the commandant. These lists will go forward as separate inclosures in order to lessen the chance of loss.

III. The personnel for special courses in orthopedic surgery will be chosen by the commandant and the list of available men should be forwarded to this office on the 15th of each month; the assignment being effective the 1st of the following month.

IV. Orders for the removal of personnel from training camp will not ordinarily be requested by this office until information is obtained by telegraph or letter from the commandant regarding advisability of the same.

V. The director of the School of Orthopedic Surgery should report on the individuals of the special courses, on the forms provided, and these reports should reach this office not

later than the 20th of the month. It is understood that these reports will necessarily not be complete but will give this office some data which, taken in connection with the report from the examining board, will facilitate distribution of the personnel.

VI. It is suggested that the director of the School of Orthopedies be given a copy of this letter and that he be empowered to communicate with this office, through channels, in regard to personnel on duty at the above-named camp.

VII. It is suggested that the director of the School of Orthopedic Surgery prepare a card index covering the men in the various phases of training who are assigned to the above-named camp and reserved for the division of orthopedic surgery.

By direction of the Surgeon General:

DAVID SILVER,
Lieutenant Colonel, Medical Corps, N. A.

The first class received the following instruction:¹²²

	Hours
Shop work.....	30
Anatomy.....	10
Lectures—didactic and clinical; quizzes and discussion of abstracts from orthopedic publications.....	10
Pathology.....	5
X ray.....	5

This allotment of hours was only tentative and is included to show the relative amount of instruction given in each division of the subject.

The instruction was divided into three parts:¹²⁵ (1) A practical course for all officers in the medical officers' training camp. (2) A similar but slightly less technical course given to 4 per cent of all the medical enlisted personnel. (3) A special course for medical officers who were assigned to the orthopedic division. The general course for the medical officers' training camp included lectures on the normal foot, with special reference to weight bearing and joint function; foot defects, including flat foot, weak foot, hallux valgus, hallux rigidus, hammertoe, bunion, etc., foot strain and its best treatment; the prevention and treatment of minor foot ailments and injuries, such as corns, calluses, blisters, etc., and the fitting and care of shoes. The second part of this course was special instruction in the use and application of splints used in the Army, and drills for the purpose of making enlisted men proficient in the rapid application of such splints as are used for the transportation of the wounded. The third division of instruction comprised lectures on the disabilities of joints.

Four per cent of all enlisted men passing through this camp received a similar course of orthopedic instruction, with the exception of the lectures on joints.¹²⁵

The special course for officers assigned to the orthopedic division was of four weeks' duration and comprised didactic and clinical instruction in all branches of orthopedic surgery useful in the Army. Special effort was put forth to make the work practical and to eliminate everything which was unnecessary from the military standpoint.¹²⁵ The work of the four weeks' course was apportioned as follows:¹²⁶

During the first two weeks of the special school, a course in anatomy of the bones, joints, and muscles, particularly of the extremities, with the nerve and blood supply, was given. The latter part of this time was occupied with the actual performance upon the cadaver of the more common operations in this branch of surgery. The course was given in the school of anatomy.

During the third week, each morning was spent in the orthopedic shop in the basement of ward R, where a course was given in the manufacture of the standard Army splints, seven in number. The officers were taught welding, brazing, forging, and leather work so that they could make any apparatus ordinarily required. The manufacture and application of plaster of Paris splints was taught to sections of the class during the third and fourth weeks, in connection with the shop work, as the plaster room was too small to accommodate all of the class at once.

In the afternoons of the third and fourth weeks, clinical demonstrations of cases from the wards and out-patient department were held twice or three times a week. Didactic lectures were given by the staff on orthopedic subjects, such as injuries and diseases of the bones, joints, muscles, tendons, and nerves. The soldier's foot and the military shoe were carefully considered. Four hours were devoted to work in the school of military Roentgenology, interpretation of plates being especially studied. The classes attended the lectures in the school of military surgery, on the use of the Carrel-Dakin method and the use of dichloramine-T. Experts from the neurosurgical school gave two lectures on peripheral nerve injuries and paralysis. The ward surgeon gave a demonstration of ward administration and paper work. The practical use of the standard splints and the Thomas splint drill were taught. A course in pathology, occupying the last hour of each day, was given by the laboratory school, and was attended by both the surgical and the orthopedic classes.

A new class was started every two weeks, so that while the old class was having its didactic and clinical work at ward R, the new class was in the dissecting room at Chattanooga.¹²⁶ It was found that, as a rule, the members of the classes needed the most elementary instruction in anatomy, and in consequence the work in the dissecting room was of the highest importance. The weekly programs were made out in advance in consultation with the adjutant of the school of military surgery, and some of the lectures and demonstrations in both divisions were attended by both the orthopedic and the surgical classes. The Medical War Manual No. 4 was used as the standard textbook. The shop instruction for the four weeks' course covered the following work:¹²⁷

First week.—Instruction in the principles of mechanical drawing and in the interpretation and making of such drawings, each man during this period making working drawings of the skeleton hyperextension splint (crab splint) No. 714 and of the combined leg and ankle splint No. 707.

Second and third weeks.—Men were instructed in shop practice and in the simpler metal-working operations, such as laying out, cutting, bending, forming, drilling, riveting, brazing, finishing, etc.

During this period each man made one of the following splints:

Skeleton hyperextension splint (crab splint), No. 714.

Combined leg and ankle splint, No. 707.

Thomas knee splint, No. 703 B.

In the case of several of the more apt men they also each made a hyperextension hand splint (cock-up), No. 713.

Fourth week.—During this period the time was devoted to plaster work. Instruction was given in the materials used and their properties, equipment necessary, preparation of bandages and their care, and in the technique of plaster application and use of apparatus.

Each man applied the following dressings: Straight cock-up splint of wrist, coaptation splint of arm, neutral elbow splint, neutral ankle splint, bracketed splint of leg.

Each two men applied: One of the various plaster jackets, spica of hip, humerus abduction dressing.

The following schedules outline in detail the instruction given in the entire four weeks' course in this school.¹²⁸

FIRST WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 a. m.	Holiday	Postures and deformities	Pathology	Pathology	Pathology	9 to 11.30 a. m. Foot and shoes
10 to 11.30 a. m.	Holiday	Standard splints	Standard splints	Standard splints	Standard splints	As above
11.30 a. m. to 1 p. m.	Lunch					
1 to 2 p. m.	Holiday	Trench foot	Quiz on splint drill	Septic arthritis, knee	Pott's fracture	Half holiday
2 to 3 p. m.	Holiday	X ray	Tuberculous joints	X ray	Peripheral nerve surgery	Half holiday
3 to 4 p. m.	Holiday		Back conditions	Osteomyelitis	Quiz	Half holiday

SECOND WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 a. m.	Pathology	Pathology	Pathology	Pathology	Pathology	Feet and shoes
10 to 11.30 a.m.	Standard splints	Quiz	Examination in the draft	Quiz	Quiz	
Lunch						
1 to 2 p. m.	Shopwork and plasterwork	Shopwork and plasterwork	Shopwork and plasterwork	Shopwork and plasterwork	Shopwork and plasterwork	Half holiday
2 to 3 p. m.		X ray		X ray		Half holiday
3 to 4 p. m.		Shopwork and plasterwork		Shopwork and plasterwork	Shopwork and plasterwork	Tuberculous joints

THIRD WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 a. m.	Shopwork and plasterwork			Anatomy, at University of Chattanooga		
10 to 11.30 a. m.	Shopwork and plasterwork			Anatomy, at University of Chattanooga		
Lunch						
1 to 2 p. m.	Clinic	Pathology	Pathology	Anatomy, at University of Chattanooga		Half holiday
2 to 3 p. m.	Arthritis	X ray	Joint lesions	Anatomy, at University of Chattanooga		Half holiday
3 to 4 p. m.	Pathology	Clinic	Differential diagnosis	Anatomy, at University of Chattanooga		Half holiday

FOURTH WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 a. m.	Anatomy, at University of Chattanooga			Shop and plaster work		
	Lunch					
1 to 2 p. m.	Anatomy, at University of Chattanooga			Pathology		Half holiday
2 to 3 p. m.						Half holiday
3 to 4 p. m.				Development battalion work	Draft exami- nations	Half holiday

The school was originally quartered in ward R of General Hospital No. 14, which was one half of a two-company barrack in the post of Fort Oglethorpe. In October, 1918, the space was found inadequate and the other half of the building, ward Q, was assigned to the school. Ward R was used exclusively for classrooms and shops, and ward Q was used for the treatment of all orthopedic cases in this hospital and also was the out-patient department.¹²⁹

The school closed December 24, 1918.¹¹⁶

SCHOOL OF MILITARY SURGERY

Prior to August, 1918, the only instruction given in general surgery was that included in the work of the School of Applied Surgical Mechanics.¹⁹ From the standpoint of general surgery this did not prove altogether satisfactory,¹³⁰ and on August 14, 1918, the School of Applied Surgical Mechanics was developed into the School of Military Surgery.¹³¹ The school thus organized completed its work and was closed December 24, 1918.¹³¹

All officers reserved for surgery by the Surgeon General's Office were required to take this course, after two weeks in the regular basic course.⁶ Even after work was started in the school the students were required to take military instruction until 9 a. m. and be present at retreat. The professional work was planned so as to minimize the didactic and accentuate the clinical and manual instruction.¹³² The hours devoted to instruction were 9 a. m. to 12 noon, and 1 to 4 p. m., except Saturday, when a half holiday was given.¹³³ A study hour from 7 to 8 p. m. was also adopted. A student instructor was in charge during the study hour, and absolute quiet was maintained. From 8 to 8.15 p. m. a quiz was held.

After the armistice the general plan of the course was changed. Formerly, the surgery of acute and general traumatic conditions was taught, but later special emphasis was laid upon the surgery of convalescent and chronic types of cases, with the idea of preparing the student to care for the large number of such cases soon to arrive from overseas.¹³⁴

A total of 701 officers received instruction in this school.¹³¹

After completion of the course the students were classified as follows:¹³¹ AA, Exceptionally good surgeons capable of high-class surgery and executive work; A, surgeons capable of conducting operating teams; B, surgeons capable of doing regular routine surgery, as hernias, appendectomies, etc.; C, qualified assistants; D, good ward men.

Any officers found not capable of qualifying in any of the five groups were ordered back to the basic course, and recommendation was made to the Surgeon General's Office to remove their names from the reserved list.¹³¹

The course as outlined covered the following subjects:¹³¹

Surgical anatomy.

Operative work on the cadaver.

Surgical pathology, particularly the reaction to trauma and infection.

Applied anatomy—operative work on the dog.

Trauma and infections of the urogenital tract from the military standpoint. (This was given to the first class.)

Trauma and infections of the eye and its appendages.

Ophthalmoscopic examinations—every man, in sections.

Trauma and infections of the ear, throat, and nose.

Otoscope examinations—every man, in sections.

Fractures, splints, traction, plaster of Paris.

Application of standard Army splints. Every man was required to apply the Thomas splints to other men in the class.

Shock, hemorrhage.

Operative technique.

Trauma of the cranium. (This was only given to the first class.)

Trauma of the face, jaws, and teeth. (This was eliminated from the later instruction.)

Ward technique:

Carrel-Dakin technique.

(a) Setting up of apparatus.

(b) Titration—every man in class.

(c) Application to patient.

Dichloramine-T technique. Dressing of patients.

Bacteriological control of infections.

Needling and transfusion. Every man in class; demonstration on each other.

Laboratory technique as applied to surgery:

Blood pressure.

Acidosis.

Application and interpretation of the flouroscope and X rays.

The disabling foot.

The disabling knee.

The disabling back.

Trauma of the chest.

Trauma of the abdomen.

The surgical complications of pneumonia.

Trench foot.

Gas gangrene.

Burns.

The acute abdomen.

The follow on to complete recovery.

Practical work:

The application of the regular splints, with special reference to the Thomas splints.

Every man applied this splint to other men in the section.

Needling of veins.

Blood typing.

Carrel-Dakin solution titration.

Dichloramine-T dressings.

Assignment to wards in the hospital.

The following schedule of professional work shows the course followed by this school:¹³⁵

Professional school
FIRST WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8 to 9	Surgery: Mechanics and symptomatology of trauma	Surgery: Basic principles on which surgical procedures must be based	Surgery: Hemorrhage, shock	Surgery: Infections and their control	Surgery: Infections and their control	Surgery: Trauma of skin and underlying soft parts
9 to 10	Pathology: Natural history of disease inflammation	Urology: Lesions of the penis; tumors of scrotum	Pathology: Specific infections	Urology: Specific and non-specific infections of the urethra	Pathology: Repair of wounds	Urology: Affections of the urethra and bladder; retention
10 to 12	Practical demonstrations will be given every day. The students will be divided into groups. These student groups will receive 4 hours' instruction in each subject on 2 successive days. (See demonstration schedules)					Orthopedics, basic principles; neurology
1.30 to 2.30	Medicine: Infectious diseases	Medicine: Infectious diseases	Medicine: Infectious diseases	Medicine: Diseases of digestive system	Medicine: Diseases of digestive system	Medicine: Duty of the medical officer in handling the sick
2.30 to 3.30	Otolaryngology: Affections of nose, throat, and ear in war	X ray: Cooperation between the Roentgenologists and the medical officer	Otolaryngology: Acute affections of the nose and throat	X ray: Uses and limitations of X ray in war	Otolaryngology: Acute affections of the ear and mastoid	Laboratory: Lecture and demonstration
3.30 to 4.30	Quiz	Quiz	Quiz	Quiz	Quiz	
	Study	Study	Study	Study	Study	

SECOND WEEK

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8 to 9	Surgery: Trauma of skin and underlying soft parts	Surgery: Trauma of bones and joints	Surgery: Trauma of bones and joints	Surgery: Trauma of thorax and contents	Surgery: Trauma of abdomen and contents	Surgery: The acute abdomen
9 to 10	Surgery: Injuries of the head and neck; concussion and compression	Urology: Affections of the prostate and seminal vesicles	Ophthalmology: Injuries of the eye	Urology: Affections of the ureters and kidneys	Burns	Urology: Syphilis
10 to 12	Practical demonstrations will be given every day. The students will be divided into groups. These student groups will receive 4 hours instruction in each subject on 2 successive days. (See demonstration schedule)					Orthopedics: Care of feet in the field and trench foot. Urology
1.30 to 2.30	Medicine: Physical examination of the lungs	Medicine: Acute diseases of the lungs	Medicine: Chronic diseases of the lungs	Medicine: Physical examination of the cardiovascular system	Medicine: Common diseases of the cardiovascular system	Medicine: Duty of medical officer in handling cardiovascular system
2.30 to 3.30	Orthopedics: Foot deformities	Laboratory: The laboratory service in the army	Orthopedics: Foot deformities, disabilities, and shoes	Surgery: Gas gangrene	Orthopedics: Derangements and disabilities of joints	Laboratory: Lecture or practical demonstration
3.30 to 4.30	Quiz	Quiz	Quiz	Quiz	Quiz	
	Study	Study	Study	Study	Study	

SCHOOL OF NEUROSURGERY

The School of Neurosurgery was organized May 9, 1918.¹³⁶ Lectures and clinics were held in the classroom set apart for this work and in the wards of General Hospital No 14, Fort Oglethorpe. Selected medical officers sent to Camp Greenleaf for training were given full-time military training for 30 days, after which they were assigned to the school for instruction. By special arrangement the military training during the 30-day period stopped at 2 p. m., and from 2 to 5 p. m. the student officers received instruction in this school. From 6 to 8 p. m. dissections, post-mortems, quizzes, and reviews of current literature were held. All student officers assigned to Camp Greenleaf who had received any neurosurgical experience were examined by the director of the school, and those found qualified for this instruction were assigned to the school.

The instruction consisted of didactic lectures covering the anatomy, physiology, and pathology of the brain, spinal cord, and peripheral nerves; treatment of cerebral traumatism, infections, etc., clinical instruction in which all suitable clinical material from General Hospital No. 14 was utilized in the demonstration of nervous diseases. This work was divided as follows:¹³⁷

Lectures:

- 10 hours. Physiological anatomy of brain, spinal cord and cranial nerves, with regional diagnosis.
- 14 hours. Gunshot injuries and traumatism of the same with diagnosis, pathology, and the indications for treatment, technique, etc.
- 9 hours. Peripheral nerves, diagnostic syndromes, anatomy, and indications for treatment.
- 20 hours. Lectures and clinics on functional and organic nervous diseases.
- 8 hours. Pathology of meningitis, tumors, syphilis, wound repair, ductless glands.
- 8 hours. Eye, ear, nose, and throat in relation to intracranial lesions and diagnosis.

Laboratory instruction:

- 16 hours. Bacterial counts, blood and spinal fluid examinations, post-mortem examinations, removal and preservation of specimens.
- 6 hours. General quizzing.

X-ray demonstration:

- 4 hours. Interpretation of plates, fractures, brain tumors, foreign bodies, etc.

In July, 1918, the school was temporarily discontinued following the departure of the officers in charge to overseas duty.¹³⁸ The section of brain surgery arranged to continue the school along the lines established by this officer, but his successor, after several months of observation of the conditions at Camp Greenleaf, officially advised against the reorganization of the school. His report embodied the suggestion that it was not possible to conduct such a school at Greenleaf. This was not approved by the director of the surgical services at General Hospital No. 14, and this disapproval was concurred in by the Surgeon General. It became apparent to the section of brain surgery in September that the available neurosurgical personnel would be insufficient to meet the requirements of the Army if, as it then seemed likely, the war should continue until the spring of 1919. It was believed that the only available source of further personnel for the section was the Medical Officers' Training Camp, Camp Greenleaf, where the majority of the members of the Medical Corps entered strictly military service. Such student medical officers, after military instruction for two weeks in the basic course, were generally assigned to the special schools in the camp for courses of professional instruction.

The reorganized school opened November 12, 1918.¹³⁹ Quarters were provided for the school in the building occupied by the School of Military Surgery. The schools of military surgery, pathology, ophthalmology, otolaryngology, Roentgenology, and plastic and oral surgery cooperated in the organization of this school, and lectures by members of the staffs of these schools constituted an important feature of the course. The hours of instruction were 9 to 11.30 a. m., 1 to 4, and 6 to 8 p. m. Twenty student officers were admitted to the reorganized school after examination to determine their qualifications for this branch of surgery. As a general rule only those men were accepted who had experience in general surgery, although exceptions were made in the cases of recent graduates who had served an internship in some hospital where the neurosurgical service was in charge of men of recognized ability. A few of the students exhibited marked aptitude for the course, the majority showed great progress, and all were enthusiastic. It did not appear to the instructors that the possible element of risk involved in teaching so vast a subject in such limited time would constitute a real menace to well-established and approved lines of training in neurosurgery.

The aims of the school were primarily to make a more intelligent selection of personnel for the enlarging demands upon the section of brain surgery and to give such personnel instruction in the fundamentals of the subject as a preparation for further clinical instruction either at the New York Neurosurgical School or at some Army hospital with adequate clinical facilities.¹³⁹ The instructors realized the impossibility of developing neurosurgeons by such a short course with the very limited clinical facilities at the camp. It was believed, however, that much could be accomplished by teaching the anatomy and physiology of the nervous system and the methods of routine neurological examination. The operative procedures in common use for brain trauma were emphasized. By arrangement with the University of Chattanooga, the anatomical department of this institution was used for work upon the cadaver and animal experimentation. It was thus possible to give a complete course in anatomy and to demonstrate a number of important physiological experiments having a direct bearing upon the problems of neurosurgery.

The schedule for the first week, November 12 to 16, 1918, was not full, owing to lack of instructors, but a full schedule was presented the week beginning November 18, 1918.¹⁴⁰

The instruction in the reorganized school was outlined as follows:¹³⁹

1. *Anatomy and physiology* (32½ hours).—These two subjects were taught together, so as to correlate closely structure and function. The subjects were taken up under seven topics, each topic considered in three ways:

- (a) Lectures on the physiological anatomy.
- (b) Anatomical demonstrations on the cadaver.
- (c) Physiological experiments on animals.

The topics were as follows:

- (1) Scalp, surface markings, osteology, blood supply, cerebrospinal circulation of the central nervous system.
- (2) Vegetative nervous system, and glands of internal secretion.
- (3) Peripheral nerves.
- (4) Spinal cord.
- (5) Hind-brain and mid-brain.
- (6) Cerebellum and thalamus.
- (7) Cerebrum.

2. *Pathology* (3 hours).—Study of cerebrospinal fluid—normal and pathologic; hemorrhage, infections, tumors of cord and brain, thrombosis, embolism, abscess, syphilis; repair of nerves, with especial emphasis on degeneration; muscle atrophy, and the obstacles to normal repair of injured nerves arising from infection; autopsies and methods of preservation of specimens.

3. *Operative surgery (cadaver)* (29 hours).—Demonstrations and lectures—immediate care of patients with war wounds of the nervous system; methods of wound sterilization and closure; treatment of hemorrhage and fracture, concussion, compression, contusion of brain; discussions of indications for surgical relief of traumatic intracranial pressure and decompression; prevention and treatment of hernia and fungus cerebri; discussion of foreign bodies; ventricular puncture and spinal puncture; injuries of spinal column and cord; laminectomy; injuries of peripheral nerves; methods of nerve repair; tumor of brain and cord; hydrocephalus; abscess; meningitis.

Operative surgery (animal); brain hemorrhage and laceration; wound closures; laminectomy and nerve suture.

4. *Clinical neurology* (18¾ hours).—The course in clinical neurology comprised lectures, quizzes, and presentation of cases.

- (1) History taking and writing.
- (2) Physical examination and record.
- (3) Sensory charts.
- (4) Visual fields.
- (5) Lumbar puncture indications; demonstration with pressure reading; interpreting in gross character of cerebrospinal fluid; laboratory examinations indicated; dangers and precautions.
- (6) Epidural injections—indications; demonstration.
- (7) Bárány test—purpose; interpretations; demonstrations.
- (8) Fundi examinations.
- (9) Case presentations.
- (10) Symposium on syphilis.
- (11) Lectures on the following: Paralysis; tremors; trophic disorders; diagnosis and localization of diseases of spinal cord; gait; ataxia; convulsions; sensation; reflexes; eye, with regard to physical signs of pupil, physical signs aside from pupil, eye reflexes; speech disturbances; aphasia; cerebrospinal fluid; electrical reactions.

5. *Ophthalmology* (4 hours).—Functional tests of ocular muscles, reflexes pupils, fundus. (Course by School of Ophthalmology.)

6. (a) *Military surgery* (4 hours).—Trauma, shock, hemorrhage, transfusion; early management of war wounds; principles of wound sterilization and healing; fractures, splints; Carrel-Dakin and dichloramine T technique. (Course by School of Military Surgery.)

(b) *Roentgenology* (2 hours).—Fracture of skull and spine; localization of foreign bodies; Roentgenology in its relation to war wounds of the nervous system. (Course by School of Roentgenology.)

(c) *Otology* (3 hours).—Tests for equilibrium; middle ear infections in their relation to sinus thrombosis and infections of the brain and its coverings. (Course by School of Otology.)

(d) *Surgical technique*.—Demonstration of surgical technique, at operations upon patients in General Hospital No. 14. Such patients were studied by the students whenever possible before and after operation. Whenever feasible, students assisted in operations.

The schedules varied somewhat, but the following are representative and show exactly how the work was divided:¹⁴¹

School of Neurosurgery—Class 1

FIRST WEEK (NOVEMBER 12 TO 16, 1918)

Tuesday	9 to 10 Method of history taking and writing	10.30 to 12 Clinic: Liberation median nerve	Lunch period (1 hour)		
Wednesday	10 to 11.30 Intracranial pressure—Lecture			1 to 2.30 Neurological examination	
Thursday		10 to 11 Intracranial pressure		1 to 2.30 Anatomy: Head and neck	2 to 3 Ophthalmology
Friday	9 to 10 Anatomy	10 to 11 Neurological examination with clinic		1 to 2 Anatomy of skull: Landmarks	2 to 3 General anatomy central nervous system
Saturday	9 to 10 Head injuries and intracranial pressure—Quiz	10 to 11.30 Clinic			

SECOND WEEK (NOVEMBER 18 TO 23, 1918)

Monday	9 to 10 Ophthalmology department; head injuries	10 to 11.30 Otology department; Bárány tests	1.30 to 2.30 Fundus examination	2.45 to 3.45 Ward N; brachial plexus	7 to 8 Pathological laboratory; pathology
Tuesday	9 to 10 Ward N; head injuries	10 to 11.30 Ward N; eyes symptoms	1 to 3 Ward N; Carrel-Dakin technique		7 to 8 Pathological laboratory; pathology
Wednesday	10 to 12 Science Building at Chattanooga University; dissection on cadaver		12.30 to 2 Chattanooga University; decompression operation	2 to 3 Chattanooga University; experimental cerebral compression	7 to 8 Pathological laboratory; pathology
Thursday	9 to 10 Ward N; trophic disturbances and convulsions	10 to 11.30 Ward N; general anatomy of central nervous system	1 to 2 Ward N; lumbosacral plexus	2 to 3.45 Ward N; clinic	
Friday	10 to 12 Chattanooga University; dissection on cadaver		12.30 to 2 Chattanooga University; osteoplastic flap	2 to 3 Chattanooga University; physiological demonstrations of sympathetic nerves	6.30 to 7.30 Ward N; syphilis and cerebrospinal fluid
Saturday	9 to 10 Ward N; hand and skin sterilization	10.15 to 11.30 Ward N; vegetative nervous system	Half holiday		

School of Neurosurgery—Class 1—Continued

THIRD WEEK (NOVEMBER 25 TO 30, 1918)

Monday	9 to 10 Ward N; cord localization and types of paralysis	10 to 11.30 Ward N; fractures of spine	1 to 2 X ray	2 to 3 Ward N; cord traets	
Tuesday	10 to 12 Chattanooga University; dissection on the eadaver		1 to 3 Chattanooga University; physiology—spinal and decerebrate preparations		6.30 to 8 Ward N; conference
Wednesday	9 to 10 Ward N; hind brain	10 to 10.45 Ward N; clinic	10.45 to 11.30 Ward N; peripheral nerve	1 to 2 Ward R; diagnosis of war wounds	2 to 3 Ward R; peripheral nerve surgery
Thursday	Thanksgiving Day				
Friday	10 to 12 Chattanooga University; dissection on the eadaver		1 to 3 Chattanooga University; operative surgery, osteoplastic flap		
Saturday	9 to 10 Ward N; mid-brain	10 to 11.30 Reflexes and sensation	Half holiday		

FOURTH WEEK (DECEMBER 2 TO 7, 1918)

Monday	9 to 9.45 Basal ganglia	9.45 to 10.30 Lumbar sacral	10.30 to 11.30 War neuroses	1 to 2 Nerve injuries	2 to 3 Clinic
Tuesday	9 to 12 Chattanooga University; spinal and decerebrate preparations			1 to 3 Chattanooga University; operative surgery	
Wednesday	9 to 9.45 Cerebrum	9.45 to 10.30 Lumbar sacral plexus	10.30 to 11.30 Cord tumors	1 to 2 Clinic	2 to 3 X ray
Thursday	9 to 10 Trauma	10 to 11.30 Brain tumors	1 to 2 Cerebrum	2 to 3 Clinic	6 to 7.30 Conference
Friday	9 to 12 Chattanooga University; dissections on cadaver			1 to 3 Chattanooga University; operative surgery	
Saturday	9 to 10 Cerebellum	10 to 10.45 Method of examination.	10.45 to 11.30 Quiz	Half holiday	

Professional school—Practical demonstration daily, 10 to 12 a. m.

	Subject	Place	Days	Num- bers (all num- bers are inclu- sive)
Group 1.....	Splints and their application..	{ Young Men's Christian Asso- ciation annex at the medical officers training camp.	{ Monday and Tuesday..... Wednesday and Thursday..... Friday and Monday..... Tuesday and Wednesday..... Thursday and Friday.....	{ 1-4 7-20 13-16 9-12 5-8
Group 2.....	{ Otolaryngology—Methods of examination.	{ Ward Q, General Hospital No. 14, unless announced otherwise. North side of the post drill grounds.	{ Monday and Tuesday..... Wednesday and Thursday..... Friday and Monday..... Tuesday and Wednesday..... Thursday and Friday.....	{ 5-8 1-4 17-20 13-16 9-12
Group 3.....	{ Carrel-Dakin technique; dichloramine-T.	General Hospital No. 14, as announced.	{ Monday and Tuesday..... Wednesday and Thursday..... Friday and Monday..... Tuesday and Wednesday..... Thursday and Friday.....	{ 9-12 5-8 1-4 17-20 13-16
Group 4.....	Pathology.....	{ Ward P, General Hospital No. 14 laboratory. North side of the post drill grounds.	{ Monday and Tuesday..... Wednesday and Thursday..... Friday and Monday..... Tuesday and Wednesday..... Thursday and Friday.....	{ 13-16 9-12 5-8 1-4 17-20
Medicine.....	{ Instruction in the hospital ward.	{ Ward T, General Hospital No. 14, North side of the post drill grounds.	{ Monday and Tuesday..... Wednesday and Thursday..... Friday and Monday..... Tuesday and Wednesday..... Thursday and Friday.....	{ 17-20 13-16 9-12 5-8 1-4

Each man will be numbered. According to the number given him, and by consulting this schedule, he will report to the group assigned his number, on that day, where the roll will be called, also by number.

The most serious defect of the course was the scarcity of clinical material for operative purposes.¹³⁸ While the wards of General Hospital No. 14 furnished a reasonable amount of material for the study of organic neurology, there were very few cases requiring surgical operation. It was possible, however, with the available cases to demonstrate thoroughly the methods of neurological examination, and in a more limited way a number of neurological lesions.

The element of time in the training of medical officers was important, for the camp school permitted both the strictly military training and professional instruction to be given during the same period.¹³⁸ A further advantage of the camp school was the full-time service of the instructors, and this enabled an amount of individual instruction not usually found when private work is combined with teaching. It is admitted that the scope of such a school is necessarily limited and preparatory in character, but it may be reasonably claimed that under the conditions existing previous to the armistice, such a school could perform a service of definite and decided value.

Examinations were held at the completion of the course to determine the qualifications of the students for neurosurgical assignments.¹³⁸ As a result of these examinations 7 of the 20 men admitted to the school were found fitted for assignments either as assistants or ward surgeons in a neurosurgical service. A number of the remaining 13 did not complete the course either because of leave, transfer orders, or discharge from the service.

The school was closed by a camp order, December 24, 1918.¹³⁸

SCHOOL OF OTOLARYNGOLOGY

The School of Otolaryngology was organized May 12, 1918, and the first class began its work on the 18th of the same month.¹⁴² A considerable number of student officers awaited instruction, and a class of 16 was detailed for that purpose. A room in ward Q of the general hospital was set aside as the lecture room and equipment sufficient to permit of beginning work the following week was gathered together. The school was operated in connection with the ear, nose, and throat department of General Hospital No. 14, and soon outgrew the quarters assigned to it. This led to the removal of the wards and the school, in July of that year, to McDonald Field, where two buildings and a half of a third building were assigned for its use. The lower floor of one of these (ward No. 29) was set aside for clinical and teaching purposes. It contained two treatment rooms, 31 by 10 feet, with concrete floors, electric lights, etc.; a well-lighted operating room, 24 by 21 feet, with concrete floor; a sterilizing room; a private treatment room for officers; a dispensary room; an office for the director; and a lecture room 48 by 24 feet in size. All of these were conveniently connected one with the other. The three wards together contained 128 beds, most of which were constantly occupied.

At the beginning the equipment of the department was exceedingly meager; one nasal speculum and a tongue depressor virtually represented all that the staff had to work with.¹⁴² A requisition for a complete list of instruments and equipment was early sent in, and in due time everything that was needed in an up-to-date ear, nose, and throat clinic, both for treatment and for teaching, was provided. Without such equipment it would have been impossible to do the work that was accomplished. The operating room was fitted up with two operating tables and a Holmes operating chair, an Ohio Chemical & Manufacturing Co. gas-and-oxygen outfit, an instrument cabinet, dressing cases, and other needed equipment. The sterilizing room was provided with an electric American Sterilizing Co. apparatus, capable of sterilizing all dressings and instruments for the department. Each treatment room contained four places for examination and treatment of patients, with a wash bowl at each place serving as cuspidor, and electric connections for lights. At the end of each room there was a place for the assistant in charge of the clinic to work. Each room was provided with a modern Wappler suction apparatus. The private treatment room also was well equipped and contained a Wappler suction outfit. The lecture room was provided with blackboards and a Bárány turning chair.

The school was particularly fortunate in possessing an unusually valuable collection of sections of the head,^d a good supply of wet specimens of the head,^e a fine collection of lantern slides of the accessory sinuses,^f and a collection of excellent slides of the ear.^{142 g} Without these collections, satisfactory teaching would have been impossible.

The clinical material was abundant at times.¹⁴² At no time were there less than 1,200 patients, and often as many as 2,000 or 2,500, in the hospital. In

^d Loaned by Lieut. Col. Harris P. Mosher, M. C., Boston, Mass., and Lieut. Col. William H. Haskin, M. C., New York City.

^e A gift of Lieut. Col. C. W. Richardson, M. C., Washington, D. C.

^f A gift of Maj. H. W. Loeb, M. C., St. Louis, Mo.

^g A gift of Dr. B. Alexander Randall, Philadelphia, Pa.

addition to this, the various camps scattered throughout the park contained as many as 60,000 troops at times and served as feeders.

Altogether, 110 student officers passed through the school.¹⁴² These were selected after careful examination by the director or his assistant, and represented only a portion of those who desired to take the course. On account of the limited time it was impossible to admit beginners, only those showing real fitness being received, and these were not allowed to continue the course in case they proved, after a short time, to be incompetent.

The course was planned to run from 4 to 6 weeks, but from the fact that the War Department did not order the men away at the end of that time it extended in many cases to 8 and 10 weeks.¹⁴² It was the endeavor to make the course as thorough as possible in the time allotted for it. It consisted of lectures and practical work, observation of operations, ward walks, and the performance of operations by the pupil himself as he showed his ability.

While care was exercised in the preliminary examination to exclude all who were not qualified, it was early found that every officer, without exception, required systematic instruction in the fundamental branches of medicine. To that end particular attention was directed to the anatomy of the nose, throat, and ear, and to the symptomatology, diagnosis, and treatment of the affections of those organs.¹⁴³

Anatomy was taught by means of wet and dry specimens, by lantern slides, and upon the cadaver. The diagnosis and treatment of the various affections of the upper respiratory tract were taught by the various members of the staff. Illustrated and comprehensive lectures on the pathology of the upper respiratory tract were given by the department of laboratories. The importance of the X ray with reference to the diagnosis of the diseases of the upper respiratory tract was emphasized. The director of Roentgenology presented this subject to each class in a series of lectures, making use of the large collection of plates at his disposal. The director of the School of Ophthalmology lectured each month on the relationship of diseases of the eye to those of the ear, nose, and throat. It was felt that every student officer should have correct knowledge of the various anesthetics for operations on the ear, nose, and throat; accordingly, a course of lectures was given each month by the chief anesthetist of the hospital. The close relationship of otology to neurosurgery was recognized, and a series of lectures was given by the director of the School of Neurosurgery. The relation of diseases of the teeth to the specialty and the important subject of wound sterilization were also presented. A brief course of lectures on the history and literature of otolaryngology was given each month by the director, which included two clinical conferences.

The subject matter of all lectures was carefully reviewed each week by a series of quizzes which served to emphasize the principal points. While it was felt that the theoretical work was essential, it was recognized that the practical work was of greater importance. For this purpose the class was divided into groups of three or four and assigned to an individual instructor, under whose direction each student officer, provided with the proper instruments, each day worked in the clinic of the department, making examinations and following out treatments. The afternoons were largely devoted to witnessing operations, of which General Hospital No. 14 afforded a rich variety, and to ward walks.

As an officer showed himself qualified, he was permitted to perform or to assist in various operations under proper supervision. Those who had shown particular ability in the course, upon its completion were taken into the wards as student assistants. This afforded an opportunity for them to receive more careful instruction and also allowed a more complete estimate of their qualifications. Those who showed particular merit were assigned to the hospital staff and remained in this capacity until they were ordered out of the camp. In this way a constant succession of qualified officers passed through the hospital, the wards of this department serving, as it were, as an advanced post-graduate training school.

Each month the class was taken into the school of anatomy (q. v.) and given an opportunity to perform the principal operations on the nose, throat, and ear under the direction of an instructor. At the end of the course each student officer was given a patient of whom he was required to make a complete examination and to report his findings in writing. A written examination covering the lectures of the course was given to each officer. Based upon the results of the examinations, together with his work in the quiz and in the practical courses the officer was rated.¹⁴³

The school closed in December, 1918.⁷²

SCHOOL OF OPHTHALMOLOGY

This school had been in contemplation for a considerable period of time prior to its organization, and from June 15 to June 20, 1918, with the approval of the commandant of the camp, a preliminary survey was made of the available buildings and of the clinical material, the possible courses of instruction in ophthalmic work, and, in cooperation with other schools already established or in process of establishment, of the laboratory facilities, the staff required, and the standards for admission. The results of this survey, incorporated in a report which was submitted to the Surgeon General and to the commandant of the camp, were approved.¹⁴⁴ On August 7, 1918, preliminary lectures and demonstrations were begun, and on August 12 the formal opening of the school took place.

The building.—A new two-story ward building of General Hospital No. 14 was placed at the disposal of this school, to which building, after completion of the necessary alterations, the ophthalmic service was transferred. The first floor was arranged and equipped as follows: There were two rooms for refraction, each provided with trial cases, standard test-type cards, all the necessary apparatus for muscle testing, and with blackboards utilized during the hours of instruction.

Adjoining the rooms for refraction, eight stalls for retinoscopy and ophthalmoscopy were erected. These stalls faced a large room where the class of student officers might gather during the hours of didactic instruction and lantern demonstration, and where perimetry was taught and practiced. The stalls for retinoscopy and ophthalmoscopy were hung with heavy curtains, which could be drawn aside or not, as the conditions required, and in the central one a lantern screen was readily adjusted, its dark surroundings enhancing the distinctness of the pictures. If necessary, the lantern could be moved to either

of the refraction rooms, where it was used in the lectures on the theory of refraction and physiologic optics. The refraction room, and the one containing the retinoscopy stalls were in communication with it through a doorway. There was a large room in one end of which the appliances for the practical optician's work were stationed, and where all of the adjustment was made of the spectacle frames in which the lenses, ground according to the formulas furnished by the ophthalmologists, were mounted. In this room, as arranged, were also the tables for the clinical clerk, who recorded each patient referred to the service and who made the preliminary visual tests and took the history. Between the area devoted to the optician's worktable and the record table there was ample space and equipment for the treatment of the external diseases of the eye. This room communicated by a double doorway with a covered porch which ran the whole length of the building, and which was utilized during the summer as a waiting room. Facing the large room previously described was a room for operations on animals' eyes (pigs' eyes, sheeps' heads, etc.), a small, well-equipped room for operations on human eyes, and an office for the chief of service and for storing the records. A commodious, admirably appointed operating room in the otolaryngological building, which adjoins the eye ward, was also at the service of the ophthalmologic staff. Operations requiring general anesthesia were performed here.

In the remaining space of the first floor of the eye building was situated a ward of 16 beds. Rooms for nurses, linen, toilets, etc., had their usual relationship to this ward.

Such an arrangement of communicating rooms rendered the examination and the assortment of patients easy, and was advantageous in the division of the student officers into classes, according to the work to which they were assigned; that is, the treatment of external diseases of the eye, perimetry, retinoscopy, ophthalmoscopy, ward instruction, operations, refraction, etc.

Equipment.—In addition to the usual equipment for an active eye service which was to be utilized in teaching, to wit: Trial cases, perimeters, surgical instruments, stereoscopes, giant magnets, tonometer, etc., certain special equipment was procured as follows: (1) A lantern for the projection of opaque objects and slides; (2) several hundred lantern slides^a; (3) about 200 microscopic slides illustrating the histology and pathology of the eye; (4) sets of Oatman's plates ("Diagnostics of the Fundus Oculi"), with the necessary stereoscopes; (5) a thermophor.

The clinical material.—The material for the clinic and the course of instruction was obtained (a) from the regular dispensary service of General Hospital No. 14; (b) from the patients in the eye ward of the same hospital; (c) from the recruits as they were examined in the camp infirmary of Camp Greenleaf and the recruit depot at Lytle; (d) from the patients in the general medical, surgical, and the neurological wards of General Hospital No. 14.

The student officers.—The student officers in the medical officers' training camp were assigned to the various schools in operation as they qualified in the preliminary examinations, which were held daily for the purpose of making

^a For the most part these were duplicates of slides used by Lieutenant Colonel de Schweinitz in the University of Pennsylvania, to which, through the kindness of Dr. Howard F. Hansell and Dr. William M. Sweet, a number of slides were added, duplications of those employed in Jefferson Medical College, Philadelphia.

this selection. The largest number of those who found entrance into the School of Ophthalmology had, prior to their assignment to Camp Greenleaf, been "exempt to ophthalmology," on the files of the Surgeon General's Office; but, a certain number were selected from among those who had entered the service without such exemption, but who at their original investigation on arrival at the camp had expressed a preference for this special type of medical and surgical work. The preliminary entrance examinations were always conducted by the director of the School of Ophthalmology, or by one of his staff, and should the applicant qualify for the school, as soon as he had completed his period of military training he received his assignment, these assignments being made on the first and fifteenth of each month.

Length and outline of the course.—The length of the course was four weeks. The hours of instruction were daily from 9.30 to 11.30 a. m., and 1.30 to 4.30 p. m., except on Saturdays, when the instruction, which consisted in a series of quizzes covering the week's work, concluded at 11.30 a. m.

The outline of the course may be briefly summarized, as follows: Two hours daily, except on Saturdays, of systematic didactic teaching, including a review of the theory of refraction, muscle testing, other functional testing, anatomy and histology of the eye and its appendages, external diseases, ophthalmoscopy, ophthalmic neurology, and operations. These lectures were illustrated by means of the lantern, diagrams, freehand drawings, etc. Particularizing as to the days: On Mondays and Tuesdays three and one-half hours, and on Wednesdays, Thursdays, and Fridays one and one-half hours, were devoted to practical instruction in refraction, muscle testing, and diseases of the eye. On Wednesdays, Thursdays, and Fridays, two hours of each day were devoted to operative ophthalmology, the director or one of the staff performing operations on the patients who came to the eye service in General Hospital No. 14, and on patients referred to the director through the courtesy of one of the eye surgeons in Chattanooga. The student officers themselves performed the usual operations on pigs' eyes and sheeps' heads.

During each course two lectures of two hours each were given to the combined class of ophthalmology and otolaryngology, one on the eye complications of sinus and mastoid diseases, and one devoted to the subject from the standpoint of the otolaryngologist. At the request of the director of the School of General Surgery, two lectures were given to his classes during the course on the treatment of injuries of the eye, and two hours per week were devoted to practical work in ophthalmoscopy.

During the course two hours were set aside for instruction in the bacteriology and pathology of the eye; and this instruction was given in conjunction with the department of pathology, and concerned itself with the study of the sections to which reference has been made and with the bacteriologic examinations of the conjunctival sac, corneal ulcers, etc. One hour was devoted during the course to X-ray localization of foreign bodies in the eye, under the auspices of the X-ray department. Through the courtesy of the department of surgery, the class in ophthalmology had the opportunity of devoting one hour daily to eye work in the genitourinary ward of United States General Hospital No. 14, going to these wards in sections, and having the advantage, therefore, of

studying the specific infections of the eye. The same opportunity, and in a similar manner, was afforded the class in the medical, neurologic, and surgical wards of the hospital, whereby a wide range of ophthalmoscopic work was covered.

Each Saturday morning a quiz was conducted by the director and instructors, one hour for the class as a whole, and one hour for sections of the class. The quizzes were both oral and written, and the week's work was reviewed. During ward instruction, practical paper work, the method of keeping records and cross indexing were demonstrated. Naturally, the schedule of instruction was elastic, and the number of hours assigned to any particular topic might be altered as was deemed necessary.

Examinations.—The examinations for entrance into the School of Ophthalmology have been briefly referred to. At the conclusion of each four weeks' course the student officers of the class were graded according to their personality, according to the character of their work, both practical and theoretical, of which cognizance had been taken by each instructor, who turned in his report on each officer with whose work he had been specially concerned, and, according to an examination which was both oral and written. All reports and examination papers were reviewed by the director of the school, who determined the grade. It was upon this final examination, thus arranged, that the officer's ultimate retention for ophthalmic work in the Army was based.

The staff.—It was determined that the personnel of the staff of the School of Ophthalmology should consist of a director of the school, who should also be chief of the ophthalmic service of General Hospital No. 14, and eight instructors, one of whom should also act as ward surgeon. Naturally, the number of instructors was subject to change, according to the needs of the school and the character of the classes. The instructors were carefully selected according to their qualifications, determined by their records as teachers and practical ophthalmic surgeons in civilian life, prior to their entrance into the Medical Corps of the Army.

Instruction.—The School of Ophthalmology was organized and was in operation for the purpose of training ophthalmologists who had entered the service as such and were assigned to the medical officers' training camp for instruction. It afforded to student officers, even though they had in civilian life devoted long periods of time to eye work, an opportunity for postgraduate ophthalmic instruction which proved to be of the utmost service. It permitted all who were engaged in this work, either as instructors or as student officers, to approach their duties from the military standpoint and its necessities, not only as they existed here, but as they obtained overseas. The advantage of observing and learning the technique of the ocular examination of recruits and registrants was a good example of the type of such work. In so far as possible, emphasis was placed on the instruction which fitted the officers for ophthalmologic service abroad. In this respect the observations which were made during several months of inspection in France and England of British, French, and our own hospital systems, had been utilized in preparing the schedules of instruction, supplemented by advices received from time to time from the overseas eye service.

A feature of importance in the School of Ophthalmology was the work which had been maintained in cooperation with the other schools at Fort Oglethorpe, to which reference has already been made, notably the School of Surgery and the School of Anatomy, the School of Otolaryngology, the X-ray department, and the departments of pathology and bacteriology. The excellent opportunities for medical ophthalmoscopy in the wards of General Hospital No. 14 have been noted. The recently established School of Oral and Plastic Surgery had already made it possible for the student officers of the ophthalmic classes to learn in a broad sense the principles of plastic surgery so necessary in acquiring the technique of blepharoplastic work—operative work of the utmost importance in ophthalmic war surgery.

The school and its work put the Surgeon General in possession of information according to which requests for the assignment of ophthalmologists to various base hospitals in this country and base and evacuation hospitals abroad could be made with an intelligent understanding of their capabilities, because each week the records of the student officers in practical work and their grades acquired according to examinations were transmitted to those who were responsible for their assignment.

As has been pointed out, the preliminary examinations for entrance into the School of Ophthalmology decided whether it was desirable that the student officer should enter the class for ophthalmic training, or whether his acquirements were such that he could be more suitably employed in some other department of military medical or sanitary science. These examinations further decided whether the previous training and experience of the student officer in civilian life had been such that it was necessary for him to add to his ophthalmic qualifications, i. e., whether he should be at the conclusion of his military training immediately assigned to ophthalmic duties here and abroad. But for those who entered the school it was the final examination after the completion of the course which determined whether an officer should continue his work in the Army as an ophthalmic surgeon, or should be assigned to other types of work for which he was more definitely suited.

The clinical material which was available for this school was unusually rich, largely on account of the permission which was granted that the recruits who were examined, as before stated, should be utilized for ophthalmic examination. The cases which came under observation and those retained for treatment compared favorably with those in any active ophthalmic service in civilian life.

Although the number of operations on human eyes was comparatively limited, excellent material in this respect was available, and all the important ophthalmic operations were readily demonstrated by means of sheep's heads and pigs' eyes, and not only demonstrated, but the student officers themselves were given the opportunity to perform them. The pigs' eyes were removed with all of their orbital attachments and surrounded by a considerable area of the skin, and therefore with complete preservation of the lids, making it possible to perform the important ophthalmic operations exactly as if they were being done on the human subject. According to an arrangement with the School of Anatomy, ophthalmic operations on the cadaver were performed.

Prior to the establishment of the Ophthalmic School the attendance in the eye service was about 260 new patients a month. This attendance rapidly increased until the new patients per month amounted to between 500 and 600, and during periods when large numbers of recruits were sent from the recruit depot and camp infirmary for examination (and all of the recruits presenting interesting ocular findings were referred to the eye clinic) as many as 1,500 new patients were examined in one month. Naturally, the recruits were not retained as patients, but none the less they were utilized in the ophthalmic instruction.¹⁴⁴

Even with this number lack of clinical material was the biggest defect in making for the best possible course.¹⁴⁵ This could have been overcome partly by placing the director of the school in charge of all of the eye work in the entire camp, as a great deal of good material was lost by not referring interesting and important cases to the school. An exception was the camp infirmary, which heartily cooperated in every way.

Inadequate space for handling large classes was perhaps of secondary importance. At one time there were 61 student officers in the school and it was utterly impossible to properly take care of them. Equipment had been lacking in the way of refraction cases, trial frames, proper illuminating fixtures for test charts, etc. Painful delay was often experienced in securing batteries for electric ophthalmoscopes and such minor things.¹⁴⁵

If the course had been lengthened to eight weeks, or even six weeks, instead of four, the men could have been trained to much better advantage, and a great number of officers could have been taken in the school and used as assistants afterwards who were lost to the department.

The total number of student officers examined for the course in ophthalmology was 185, of whom 129 were found qualified for the course; of these, 109 were assigned to the course, 93 being finally qualified.¹⁴⁵

The dominant thought in teaching was primarily to instill the idea of system and thoroughness—systematic method of making external examinations, and of making records and reports. It was found that even with physicians with practical ability and excellent reputation, the lack of system, admittedly, was their most serious defect.¹⁴⁵

Schedule of course in ophthalmology for December, 1918.¹⁴⁵

FIRST WEEK

	Monday	Tuesday	Wednesday	Thursday	Friday
9 to 10 a. m.	Lecture: "Routine of examination of patients"	Lecture: "Retinoscopy"	Lecture: "Physiological optics"	Lecture: "Functional testing"	Lecture: "Lids and lacrymal apparatus"
10 to 11.30 a. m.	Practical work	Practical work	Practical work	Practical work	Practical work
1.30 to 2.30 p. m.	Lecture: "Refraction"	Lecture: "Muscle testing"	Lecture: "Surgery of lids"	Lecture: "Principles of plastic surgery"	Lecture: "Surgery of conjunctiva"
2.30 to 3.30 p. m.	Practical work	Practical work	Practical work	Practical work	Practical work
3.30 to 3.45 p. m.	Quiz; conference	Quiz; conference	Quiz; conference	Quiz; conference	Quiz; conference

Saturday, 9 to 11 a. m., quiz.

Schedule of course in ophthalmology for December, 1918—Continued

SECOND WEEK

9 to 10 a. m.	Lecture: "Conjunctiva"	Lecture: "Cornea"	Lecture: "Uveal tract"	Lecture: "Media and sclera"	Lecture: "Fundus"
10.30 to 11.30 a. m.	Practical work	Practical work	Practical work	Practical work	Practical work
1.30 to 2.30 p. m.	Microscopical pathology; progressive sectional groups	Microscopical pathology; progressive sectional groups	Lecture: "Surgery of conjunctiva"	Lecture: "Surgery of eye muscles"	Lecture: "Surgery of orbit"
2.30 to 3.30 p. m.	Practical work	Practical work	Practical work	Practical work	Practical work
3 to 4 p. m.				Lecture: "Accessory sinuses"	
3.30 to 3.45 p. m.	Quiz; conference	Quiz; conference	Quiz; conference		Quiz; conference

Saturday, 9 to 11 a. m., quiz.

THIRD WEEK

9 to 10 a. m.	Lecture: "Heterotopia"	Lecture: "Functional testing"	Lecture: "Pupillary reflexes and visual paths"	Lecture: "Focal infections"	Lecture: "Fundus"
10 to 11.30 a. m.	Practical work	Practical work	Practical work	Practical work	Practical work
1.30 to 2.30 p. m.	Microscopical pathology; progressive sectional groups	Lecture: "Fundus"	Lecture: "Surgery of cataracts"	Lecture: "Surgery of glaucoma"	Lecture: "Surgery of foreign bodies"
2.30 to 3.30 p. m.	Practical work	Practical work	Practical work	Practical work	Practical work
3.30 to 3.45 p. m.	Quiz; conference	Quiz; conference	Quiz; conference	Quiz; conference	Quiz; conference

Saturday, 9 to 11 a. m., quiz.

FOURTH WEEK

9 to 10 a. m.	Lecture: "Injuries"	Lecture: "Neurology"		Lecture: "Accessory sinuses"	Lecture: "X-ray localization of foreign bodies"
10 to 11.30 a. m.	Practical work	Practical work	Practical work	Practical work	Practical work
1.30 to 2.30 p. m.	Lecture: "Fundus"	Lecture: "Fundus"		Surgery	Surgery
2.30 to 3.30 p. m.	Practical work	Practical work		Practical work	Practical work
3 to 4 p. m.		Lecture: "Bacteriology and pathology of eye"			
3.30 to 3.45 p. m.	Quiz; conference			Quiz; conference	Quiz; conference

Saturday, 9 to 11 a. m., quiz.

Practical work in the course included:¹⁴⁵ Refraction; muscle testing; outlining visual fields and scotomata; examinations of fundi in wards and clinic; examination of external diseases in patients in wards and clinic; operations on pigs' eyes and on patients in General Hospitals No. 14 and in West-Ellis Hospital in Chattanooga. The talks on surgery were illustrated by lantern slides and drawings and were followed by the operation itself on animals' eyes, patients, or cadaver; also practical paper work and demonstration of method of keeping records and cross indexing. In quiz conference held daily at 3.30 p. m., the student officers asked questions of the director concerning anything that had come up during the day. This schedule showed the final development of the school.

The school closed December 24, 1918.⁷²

SCHOOL OF UROLOGY

The School of Urology was organized during February, 1918. The first course of instruction began on March 1.¹⁴⁶ The school was established in the base hospital at the camp, the genitourinary service of which was thoroughly reorganized and an excellent clinic arranged for purposes of teaching. The courses given were intensive, but thorough. The curriculum provided for theoretical instruction and the practical application of the most advanced methods, the clinical material being provided at the hospital. All laboratory work in connection with this service, with the exception of Wassermann tests, was done in the genitourinary ward, by student officers under competent supervision. Dark field illumination examinations were made daily and every man was taught the use of the endoscope and the cystoscope.¹⁴⁶

Many of the applicants for instruction in the school were found, upon examination, to be better suited to other branches of medicine, and were transferred accordingly.¹⁴⁷ In order to select properly qualified men, all student officers who applied were examined before they were taken into the classes, the examinations being oral, written, and practical. It was the object of the director to take such qualified men as were left, and to give them the excellent advantages offered by the clinic.

It was not hoped to make surgeons of these students, but the purpose was to acquaint them with the important points in urology. The subjects taught comprised differential diagnosis, genitourinary therapy, clinical laboratory work, minor surgery, endoscopy, cystoscopy, urethral catheterization, renal functions, diagnosis and treatment of lues.¹⁴⁸

The diagnosis and treatment of chronic gonorrheal urethritis and its complications was stressed in order that officers who became qualified for assignment to organizations, would be fully equipped to aid in the solution of the problem of noneffectives, the result of gonorrhea, many thousand of such cases having been accumulated in development battalions.¹⁴⁸

It was soon found desirable by the director to secure an assistant, especially trained in laboratory and clinical microscopy; this proved of great advantage, not only to the student body, but also to the general hospital, in the recognition and intelligent conduct of such cases classified as venereal and genitourinary. About the same time it was also found necessary to have assigned to the school

an assistant especially trained in the diagnosis and treatment of dermatological cases.¹⁴⁹

The course of instruction extended over a period of approximately one month. The first two classes contained 7 and 8 students, respectively,¹⁵⁰ but later the classes became much larger, reaching approximately 40 men in September, 1918.¹⁵¹

The school closed the latter part of December, 1918.⁷²

SCHOOL OF PLASTIC AND ORAL SURGERY

The School of Plastic and Oral Surgery began its work October 22, 1918.¹⁵² Only two classes received instruction, and the school closed December 24, 1918.¹⁵³ The classrooms used were in the building occupied by the School of Military Surgery. The course given from October 22 to November 16, 1918, with the amount of time devoted to the various subjects, is outlined below:¹⁵²

Surgical anatomy of head and neck:	Hours
Demonstrated by special dissections on cadaver.....	15
Demonstrated by special dissections on bones of the face.....	5
Demonstrated by lantern-slide illustrations.....	2
Didactic lectures and recitations.....	5
Total.....	27
Operative course:	
Principles of plastic surgery (didactic).....	10
Plastic methods on the cadaver.....	15
Plastic methods on anesthetized animal.....	2
Plastic methods on eyelids and conjunctiva (pigs' heads used).....	4
Total.....	31
Fractures of jaws:	
Fractures and theory of jaw splinting (didactic).....	3
Descriptions and lantern-slide illustrations on types of splints.....	1
Practical demonstration of dental appliances used in treatment of jaw fractures....	1
Practical demonstration of prosthetic appliances used in maintaining contour of face during period of reconstruction.....	1
Total.....	6
Anesthesia:	
Local anesthesia—	
Varieties, methods of use, technique, anatomic locations of points for nerve blocking, conditions in which applicable, when advisable.....	4
General anesthesia—	
Varieties and methods of administration. Precautions to be taken before, during, and after operations, intratracheal method described in detail and technique of introduction of tube shown on cadaver intrapharyngeal and intranasal methods.....	3
Total.....	7
Wounds of face, mouth, and jaws:	
Trauma of skin and underlying soft parts.....	1
Injuries to salivary glands and their ducts, salivary fistula.....	2
Wound dressings.....	2
Value of rest in treatment of wounds.....	1
Infections and their control.....	2
Complications and their treatment.....	3
Total.....	11

Miscellaneous subjects:	Hours
Mouth infections.....	2
Necrosis of jaw.....	1
Tumors of the jaw and the tongue.....	2
Diseases of the sinus maxillaris of oral origin.....	2
Burns and methods of treatment.....	1
Deformities due to scar tissue contractions.....	2
Skin grafting—Varieties and technique.....	2
Hemorrhage and shock.....	2
Intravenous injections and blood transfusion.....	1
Postoperative care of patients.....	1
Nerve trauma in repair—Repair of divided nerves, neuralgia.....	3
Roentgenology in its relation to plastic and oral surgery.....	2
Total.....	21
Total length of course.....	103

Subjects of lectures and demonstrations given to class No. 1 by the staff of the School of Plastic and Oral Surgery, Camp Greenleaf, Chickamauga Park, Ga., from October 22 to November 16, 1918:

Basic principles of plastic surgery.
 War injuries of face and jaws. Types and treatment.
 Demonstrations of plastic methods and types of operations shown on cadaver and on anesthetized animals.
 Fractures of jaws. Varieties of splints most applicable.
 Mouth infections. Necrosis of jaw.
 Bone grafts and cartilage transplants.
 Skin grafting.
 Scar tissue contractions. Results of operative measures to correct.
 Salivary fistula. Ranula.
 Surgical anatomy of head and neck, with demonstrations of special dissections.
 Principles of plastic surgery.
 Plastic operations on cadaver and anesthetized animal.
 Local anesthesia. Detailed technique.
 General anesthesia. Precautions before, during, and after.
 Intratracheal and intrapharyngeal technique.
 Injuries of the tongue and floor of the mouth.
 Fractures of the jaws.
 Complications following mouth injuries.
 Tumors of jaw.
 Nasal deformities.
 Injuries of salivary glands and ducts.
 Burns.
 Skin grafts: Varieties. Technique.
 Hemorrhage and shock.
 Intravenous injections and blood transfusion.
 Semiweekly reviews and quizzes on important practical points.
 Review of principles of plastic surgery.

Subjects of cooperative lectures and demonstrations given the students in the School of Plastic and Oral Surgery by the directors and instructors of other schools at Camp Greenleaf from October 22 to November 16, 1918:

School of Military Surgery—

Trauma.
 Infections and their control.
 Value of rest in the treatment of wounds.
 Demonstration of wound dressing.
 Bacteriologic control of wounds.
 Carrel-Dakin treatment.
 Dichloramine-T.

School of Otolaryngology—

Surgical anatomy of the nasal area.

Infections of the sinus maxillaris of traumatic origin.

School of Ophthalmology—

Emergency treatment of eye injuries.

Plastic operations on eyelids and conjunctiva. (Demonstrated on pigs' heads.)

School of Roentgenology—

X ray in its relation to plastic and oral surgery.

School of Neurosurgery—

Nerve trauma.

Nerve repair.

Neuralgia.

School of Dental Surgery—

Dental appliances used in treatment of jaw fractures.

Prosthetic appliances used in maintaining contour of face during period of reconstruction.

The schedules for the first class were as follows: ¹⁵²

Class 1.—*School of Plastic and Oral Surgery*

FIRST WEEK (OCTOBER 22 TO 26, 1918)

Hours	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10		Head injuries	Fractures of jaws (illustrated by lantern slides)		
10 to 11	Demonstration of elasticity of tissue; transverse incision suturing in vertical plane; flap sliding, taking tissue from neck	Anatomy of scalp and superficial portions of face and neck			Treatment of fractured jaws
10 to 11.15			Muscles of mastication; their influence in displacing fragments in fractured jaws; burns and scalds	Entire day given to addresses by surgeons of England, France, and Italy dealing with surgical procedures used to greatest advantage in dealing with war wounds	
11 to 12	Demonstration of lip and mouth injuries approximated so as to form a red epithelial border; flap from forehead to repair defect in cheek; flap from neck to repair defect in cheek; flap from forehead to form a new nose				Wounds and contusions and the principles underlying their treatment; special consideration of wounds of the mouth and their complications

Class 1.—*School of Plastic and Oral Surgery*—Continued

FIRST WEEK (OCTOBER 22 TO 26, 1918)—Continued

Hours	Tuesday	Wednesday	Thursday	Friday	Saturday
12 to 2	Lunch and study				
2 to 4	Importance of sufficient width of base, and circulation for all flaps used in plastic work; Beck's method of promoting epithelial growth by strapping wounds; demonstration of use of stay sutures, and forms of dressings to relieve tension of tissues in operative field		Practical demonstrations of wound dressings		Half holiday
2 to 3		Mouth infections			
3 to 4		Lantern demonstration of operative results in plastic work; removal of scar tissue contractions of neck, lip, and nasal cases			

SECOND WEEK (OCTOBER 28 TO NOVEMBER 2, 1918)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10	Surgical anatomy of the nasal area; wet and dry specimens	Surgical anatomy of the nasal area	Surgical anatomy of the nasal area	Principles of skin grafting	Entire day's work in anatomic rooms in plastic operations	Value of rest in treatment of wounds
10 to 11.30	Injury to salivary glands and their ducts, treatment of salivary fistula	Mouth infections; necrosis of mandible	(Anatomic room.) Basic principles of plastic surgery; technique of skin approximation	Traumatic conditions of antrum and treatment	Ligations of vessels of neck. Bone implantations in nasal area, and into jaw	Hemorrhage and shock
12 to 2	Lunch and study					
2 to 3	Complications following injuries about face and jaws, and treatment	Relations of bones of face and points of muscular attachment; relations of accessory sinuses shown on specially dissected skulls	Operations upon anesthetized dog; ligations of vessels and flap formations; varieties of skin grafts, operations about eyes and mouth	Dental appliances used in treatment of jaw fractures and prosthetic appliances used in maintaining contour of face during period of reconstruction	Plastic operations reconstructing area about eyes; resections of temporo-mandibular joint	Half holiday
3 to 4	Trauma of skin and underlying soft parts					

Class 1.—*School of Plastic and Oral Surgery*

THIRD WEEK (NOVEMBER 4 TO 9, 1918)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10	Entire day devoted to anatomic work in anatomic laboratory, Chattanooga	Entire day devoted to anatomic demonstrations dealing with points and relations essential in plastic and oral surgery; anatomic laboratories, Chattanooga	Nerve trauma; repair of divided nerves	Trauma	Injections and their control	Local anesthesia
10 to 11.30	Specially prepared dissections of head and neck demonstrated by the staff of instructors of the school		Quiz and review of basic principles of plastic surgery	General anesthesia, varieties and methods of administration; precautions to be taken before, during, and after operations	X ray in its relation to plastic and oral surgery	Weekly review of practical points
11.30 to 1.30	Lunch and study					
1.30 to 2.30				Plastic surgery in the area surrounding the eyes	Plastic surgery of the conjunctiva	Half holiday
2.30 to 4			The nasal accessory sinuses in relation to trauma of the face and plastic surgery (lantern-slide illustration)	Practical work; operations upon eyelids (pigs' heads used in this work)	Practical work; operations upon eyelids and conjunctiva (pigs' beads used)	

FOURTH WEEK (NOVEMBER 11 TO 16, 1918)

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10	9 to 10	9 to 10	9.30 to 12	9.30 to 12	9 to 10
Varieties of local anesthesia (continued)	Discussion of questions brought up by class regarding local anesthesia	Mouth infections	Plastic operations and anatomic demonstrations on cadaver in anatomic laboratories, Chattanooga University	Plastic operations and anatomic demonstrations on cadaver in anatomic laboratories, Chattanooga University	Diseases of the maxillary sinus complicating or secondary to oral surgical condition
10 to 11.30	10 to 11.30	10 to 11.30			10 to 11.30
Injuries to the seventh nerve; treatment	Tumors of the jaw	Trigeminal neuralgia; treatment			Weekly review of practical points
11.30 to 2 Lunch and study			12 to 1 Lunch and study		11.30 to 2 Lunch and study
2 to 3	2 to 3	2 to 3	1 to 3	1 to 3	Half holiday
Technique of using local anesthetics	Quiz; the seventh and fifth nerves	Repair of destructive injuries about lips and of palate	Plastic operations and anatomic demonstrations on cadaver in anatomic laboratories, Chattanooga University	Plastic operations and anatomic demonstrations on cadaver in anatomic laboratories, Chattanooga University	
3 to 3.45	3 to 3.45	3 to 3.45			
Anatomic locations of points for nerve blocking and routes of approach	Class dismissed to attend lecture by Ambassador Morgenthau	Intravenous injections; blood transfusions			

SCHOOL OF MILITARY ROENTGENOLOGY

The School of Military Roentgenology was established January 2, 1918,¹⁵⁴ and closed in January, 1919.¹⁰⁶

The function of the school at this time was to select the medical officers best fitted for service as Roentgenologists, and to give them a preliminary course of instruction in the following subjects: Principles of interpretation anatomy (particularly of the bones and joints) as revealed by X-ray plates; pathologic changes; standard radiographic positions (drill); fluoroscopy; stereoscopy; report writing, and the handling of exposed plates. This work was carried on in the X-ray department of the base hospital, Fort Oglethorpe (General Hospital No. 14), which consisted of a radiographic room, a fluoroscopic room, and a very small developing room. The space was inadequate, but the clinical material was extensive, and the enthusiasm of the instructors, as well as student officers, was of a high degree. It was apparent that much could be accomplished in larger quarters, and it was the early conviction of the director that with adequate accommodation and equipment, there were many advantages in favor of making this a school for a complete course of training, where all such training in the United States could be accomplished.

Because of the crowded condition of the hospital, extra space was difficult to obtain. During the latter part of March steps were taken to secure post barracks building S for the X-ray department of the hospital. The localization laboratory, consisting of six complete units, was installed in temporary quarters, so that instruction in localization of foreign bodies was started on July 17. The elementary and advanced physical laboratories were installed in hospital tents and were ready for operation when electric current was first available on July 24. By working three sections a day the student officers of the previous classes had received their final instruction in machine construction, repair and operation, and in localization of foreign bodies, by August 6, and their work was so arranged that the class entering the school August 1 could take up the regular assignments of the complete course. Work in the tents and temporary localization laboratory continued throughout the time that the building S was being arranged for the X-ray laboratory of the hospital for the permanent quarters of the school. These changes were practically completed by the middle of August, 1918.

No sooner had the new building been occupied than it was called upon to take larger classes. The space and assignment sheet permitted of doubling the output, and it was decided to shorten the course to two months in order to hasten the supply of Roentgenologists. In shortening the course, the more advanced clinical instruction was sacrificed more than work in localization of foreign bodies, the machine course, and the anatomy and position drill.

By the middle of September the school was called upon, in the following communication, again to double the number of student officers and enlisted men; or, in other words, to furnish 100 officers and 100 enlisted men each month.¹⁵⁵

¹ Based, in the main, on: "The Camp Greenleaf School of Roentgenology" by Lieut. Col. Willis F. Manges, M. C. published in the *American Journal of Roentgenology*, New York, 1919, vi, n. s., No. 7, 305.

SEPTEMBER 28, 1918.

From: The Acting Surgeon General, United States Army.

To: Maj. Willis F. Manges (through the commandant), Camp Greenleaf, Ga.

Subject: Memorandum on enlargement of school of Roentgenology.

1. *Arrangement of course.*—Capacity of school desired:

Medical officers each month.....	96
Manipulators each month.....	96
Manipulators, to be trained at Army Medical School during temporary stress, per month.....	48

The principal business of the Camp Greenleaf school is to properly train medical officers, and this should not be lost sight of in the effort to turn out manipulators. A greater number of manipulators than 96 would be welcome, but it is believed that it would interfere with giving proper attention to the medical officers.

Of the medical officers, the training is to be as follows:

Men qualified in interpretation and the medical phases of the work to handle base hospitals.....	72
Men well qualified only for localization.....	24
	<hr/> 96
Men especially qualified to operate base hospital type of apparatus.....	24
Men especially qualified to operate portable unit.....	72
	<hr/> 96

Of the manipulators, training to be substantially equal for all men. The courses as arranged in the outline submitted is excellent and should prove very workable. The use of trays for developing instruction is indorsed. It conforms to practice of the schools of aerial photography at Rochester and Ithaca. Present plans for the manipulators' course are heartily approved. A copy of the outline of the course and series of questions for the guidance of instructors, as mentioned in the plan of instruction of manipulators just submitted, is desired by this office when the outline is compiled.

It is the firm opinion of the undersigned that four students per machine can not be properly instructed in the elementary laboratory. There just isn't room for 24 men and the necessary instructors in the laboratory at one time, and there are not machines enough to keep the men busy. Better work, fewer men, and less time per section, and double the number of sections until such time as additional instruction units can be had. Parts for these are under order, as listed under "New equipment."

Ambulance.—The rate of training of teams for the ambulance should be at present about 10 teams each month. Each team is to consist of a medical officer and two enlisted men. This output is subject to revision in accordance with news from overseas.

* * * * *

By direction of the Acting Surgeon General:

GEO. C. JOHNSTON,
Lieutenant Colonel, Medical Corps, United States Army.

This required both additional space and a rearrangement of the assignments so that 50 officers and 50 enlisted men could be taken into the school each two weeks. Accordingly the adjoining building, known as T, was secured and fitted up for the purpose.

The teaching staff had to be enlarged each time the demands were increased. A medical officer who had been in active service in France for more than one year came to the school early in September and delivered a course of lectures with a view of bringing to the instructors and student officers an intimate knowledge of the conditions at the front. This close contact with one who had been at the front was a factor of appreciable value to the director as well

as to the instructors and students. Instructors at all times were selected solely on their fitness to teach some particular phase of the work, and in the majority of instances were officers who previously had been student officers in the school. In this way the desired results were obtained without at any time having kept at the school large numbers of men who had a wide practical experience. Each instructor was given the opportunity of selecting his own assistants from the classes; and, wherever it was possible, enlisted men or noncommissioned officers or Sanitary Corps officers were used in the strictly technical or mechanical phases of the instruction; for example, in the developing room, physical laboratories, and mobile unit manipulation. The instruction to manipulators was given entirely by Sanitary Corps officers and enlisted personnel.

The curriculum of the school was at all times based on the idea that men were being trained to do the kind of X-ray work that was met with at the front, both in the forward hospitals and those farther from the fighting line. It was of prime importance that the officer should be able to operate properly any type of machine; and to keep his machine in operation even under the most trying circumstances, that he should know all parts of his apparatus thoroughly so as to be able to directly supervise the installation or dismantling and transportation. The instruction in development of plates was given with more intensity to the manipulators than to the officers.

The course in anatomy and position and exposure drill was looked upon as one of the important features, since the whole subject of reports, whether of localization of foreign bodies, of fractures, or other lesion, is based upon an accurate use of anatomical terms, and knowledge of the appearance of the normal was considered essential to the easy recognition of the abnormal. It also afforded the opportunity to all of the students of making practical application of the instruction they had just received in the machine course. This course was further augmented by fluoroscopy of the normal.

Localization of the foreign bodies was taught just as thoroughly as possible, with complete equipment and models containing foreign bodies. It was one of the most satisfactory features of the course, as well as one of the most important.

Of the clinical subjects, most attention was paid to fractures and diseases of the bones and joints, especially the infections following war injuries. In addition to the lecture course, in which carefully selected lantern slides were used for illustration, a large collection of original radiographs was studied by sections of the class under the guidance of assistant instructors. Special consideration was given to the matter of report writing in such cases.

The instruction with reference to the chest and its contents followed very closely the text of the United States Army X-ray Manual, and lantern slides were depended upon largely for instruction in interpretation. The hospital furnished a large amount of lung material, so that each student studied numbers of patients both fluoroscopically and by means of stereoscopic plates, or single plates taken at the bedside. The time allotted for this instruction permitted close attention only to the more gross lesions, such as fairly well advanced tuberculosis, pneumonic consolidations, effusions, and pneumothorax. The

diseases of accessory sinuses, mastoids, and teeth were taught by means of lantern slides as well as by section work in the radiographic and view box rooms. The clinical material was at all times abundant.

Instruction in the diseases of the gastrointestinal tract and urinary tract was given by means of slides and in the radiographic and fluoroscopic rooms. No attempt was made to be thorough except in the matter of technique. This class of patients, however, furnished opportunity for a large amount of fluoroscopy, and no occasion was lost to give the student officers opportunity to use the fluoroscopic apparatus.

All departments of the hospital were encouraged to request bedside examinations of patients too ill to be moved. This work was done mainly by the students under the supervision of a capable instructor. The results were of surprising excellence, and the number of patients examined per day was usually quite large. This bedside work was thoroughly appreciated by the various chiefs of service, and was of the utmost value to the school as a means of instruction.

Instruction in the therapeutic use of the X ray was limited to individual training in operation of the Coolidge tube at a standard treatment exposure set of conditions, and in the use of filters, protection of surrounding parts, etc. No attempt was made to teach the application to any particular disease.

Instruction to enlisted men was limited to the operation, care, and repair of apparatus, to developing-room work, to assisting in the radiographic and fluoroscopic rooms, and to the filing of records and plates.

In addition to the instruction given to the students of the School of Roentgenology, courses of illustrated lectures or fluoroscopic demonstrations were given to the student officers of the various other schools at Camp Greenleaf. For example, two lectures a week were given to the School of Surgery, two to the School of Orthopedic Surgery, one to students in otolaryngology, one in oral and plastic surgery, and occasional demonstrations to the School of Cardiovascular and Lung Diseases. The object of these lectures and demonstrations was to acquaint the several specialists with the sort of aid they might expect to get from the X-ray department, and to cultivate as much as possible a spirit of cooperation. This matter of cooperation was further carried out by having available at all times a capable instructor who could take plates and records to the surgical operating rooms or wards on occasions when such records might be of value in operations or in the instruction of the various classes. The instruction thus given to the various other specialties was started early in January, 1918, and was carried on throughout the year, with a great deal of benefit to all concerned. In fact, this very feature was looked upon as one of the important reasons for having a complete School of Roentgenology at Camp Greenleaf.

The floor plan of building S was arranged with special attention to the handling of a large number of patients; or, in other words, primarily as an X-ray department of the hospital, and secondarily for school purposes. Fortunately, the plan worked well for both, the first floor and part of the second floor being reserved especially for the accommodation of patients and the remaining part of the second floor, as well as two basement sections, being used for school pur-

poses. All changes were planned in such a manner that by the mere tearing down of the partitions and removal of apparatus the building would be in its original condition without damage. The partitions, ventilation, light-proof shutters, and most of the wiring in this building was done by outside contractors, but all of the installations and a considerable amount of wiring was done by the officers and enlisted personnel of the school. All of the work in building T was done by the school organization and furnished a great deal of very valuable training, especially to the students of the enlisted personnel.

Selection of student officers for the School of Roentgenology was always a matter of considerable moment to the director, and the process went through a sort of evolution in keeping with the development of the camp as a whole. During the first months a great deal of individual effort was necessary in order to find the officers who had had previous X-ray experience, and it was at times difficult to get and especially to hold them. The plan of calling for volunteers by means of notices read to the companies brought forth a large number of applicants, among them many who were not well fitted for the work, but the plan did have the advantage of bringing the opportunity to the attention of those who had had previous experience. The greatest objection to this plan was the fact that it frequently turned out that the men selected had been retained in the Surgeon General's Office for some other service, this being learned only when orders came taking such men from the school. Later, the board of examiners, who examined all officers entering the camp in surgery and medicine, referred to the X-ray school all officers who claimed to have had any experience whatever in X-ray work or who especially desired to take up the work. By this means a little more than half the desired number of students was obtained. In order to fill up the classes the president of the board of examiners selected from the files the cards of men who had passed good examinations in surgery but who had not been taken up by the surgical chief. It was considered a matter of importance that the student Roentgenologists should know surgery, for they were to be surgical assistants of the first degree of importance. With this class of officers, mostly under 40 years of age, some of the most gratifying results were obtained. They were particularly adaptable to training for forward hospitals where the work was largely a matter of localization of foreign bodies and the study of fractures. This plan was found to be the best obtainable and was fairly satisfactory.

The enlisted personnel was obtained entirely through various group commanders, being selected, as far as possible because of their fitness, from among the limited service men. Those who could not readily grasp the work were sent back to their former organizations.

The whole scheme of instruction worked well, and the schedule, as to the number of hours devoted to each phase of the subject, represented the minimum that was practicable for obtaining efficient results.

OUTLINE OF COURSE IN X-RAY PHYSICS AND ELECTRICITY, ELEMENTARY AND ADVANCED
LABORATORIES

Purpose of the course.—This course was designed to acquaint medical officers selected for X-ray service with the various types of apparatus they might be called upon to operate when assigned to duty. While there was no intention to attempt to make electricians or physicists of them, still a considerable amount of time was spent upon the principles underlying the production of X rays. This was deemed necessary in order that the men might have a basic knowledge that would enable them to render continuous efficient service under the varying and often adverse conditions of military Roentgenology.

Outline of instruction.—Laboratory work comprised the major part of this course. The sections and apparatus were so arranged that each man must himself do the work under the supervision of an instructor. The only objection to this plan was that it demanded more than the usual number of instructors and hence added expense. This objection was largely overcome by using selected enlisted men to act as assistants on the various units, all work being done under the direct supervision of a medical officer.

The laboratory work was given in several parts. First, the men gained a fundamental knowledge of electricity by making selected experiments on a unit called the "principles of electricity table." Hereafter this unit is designated by the term "principles table." The class was given instruction in the operation of the rectifying type of machine on units called "test machines." Succeeding this, the following units were taken up: United States Army portable gas electric set, United States Army portable instrument box, United States Army bedside unit, induction coil outfit (gas tubes) and, finally, the various makes of base hospital machines.

Each morning, before the class went into the laboratory, the lecture was given. The course of lectures was designed to parallel the laboratory work as closely as possible, and followed literally the text of the manual, with simple analogies for explanation. The last five lecture periods were devoted to review, and opportunity was given the class to clear up any points not made clear on first presentation.

The school day was made up as follows:

(a) For medical officers during their first month of instruction:

8.30 to 10.30.....	Section work as assigned.	1 to 2.....	Lecture.
10.30 to 11.30.....	Lecture.	2 to 4.30.....	Section work.
11.30 to 1.....	Mess.		

(b) For medical officers during their second and third months of instruction:

8.30 to 9.30.....	Lecture.	1 to 2.....	Lecture.
9.30 to 11.30.....	Section work as assigned.	2 to 4.....	Section work.
11.30 to 1.....	Mess.		

(c) For enlisted men throughout their course:

8.30 to 9.....	Care of the apparatus.	1 to 2.....	Lecture.
9 to 11.30.....	Section work as assigned.	2 to 4.30.....	Section work.
11.30 to 1.....	Mess.		

The lectures were divided among the various subjects as follows:

(a) Medical men during their first month (this series of lectures repeated monthly):

Physics and electricity.....	15
Review quiz.....	5
Developing.....	5
X-ray anatomy.....	10
Positions.....	5
	<hr/> 40

(b) Medical men during their second and third months (this series of lectures repeated every two months):

Principles of interpretation.....	1	Head and dental.....	10
Stereoscopy.....	1	Orthopedic.....	5
Fluoroscopy.....	2	Therapeutics.....	2
Fractures and bone lesions.....	15	Reports and records.....	2
Heart and lungs.....	10	Duties of the Roentgenologist.....	1
Pathology (by a pathologist).....	10	Miscellaneous.....	6
Localization.....	5		<hr/> 80
Gastrointestinal.....	8		
Urinary tract.....	2		

(c) Enlisted men (this series of lectures repeated monthly):

Physics and electricity.....	15	Records and filing.....	2
Review quiz.....	5	Duties of manipulator.....	1
Dark room work.....	5		<hr/> 30
Handling of patients.....	2		

MANIPULATORS' SCHOOL

Instruction for manipulators was limited to the theory, operation, maintenance, and repair of the various types of apparatus. During the last few months only a small percentage of enlisted men were brought in contact with the large so-called base hospital machines. These were the men who, by reason of previous experience or education, were especially fitted for such instruction. Their course in the handling and caring for the portable types and induction coil outfits, and especially in the Delco engine, was very thorough.

Their instruction in position and exposure drill was limited, and given in such a way that it served more to fasten in their minds the knowledge they had gained in the machine and developing work than to make real operators of them. Anatomical terms, other than those familiar to any schoolboy, were not used, and only the more common positions were practiced.

The instructors were Sanitary Corps officers or graduates of former classes. The teaching facilities were constantly increasing, so that there was a continuous demand for practical work in the way of wiring, both low and high tension; assembling and adjusting apparatus, and installing the various machines. The manipulators under the direction of their instructors made all the changes in building T, even to building the developing counters and to mounting the extra large step-down transformer. In short, it was the purpose of the school to train them to be useful and practical assistants to medical officers, and to keep them just as far from actual professional duties as possible.

The assignments of these men in the developing course were similar to those of the officers. Their hours in the machine course were so arranged as not to conflict with the officers.

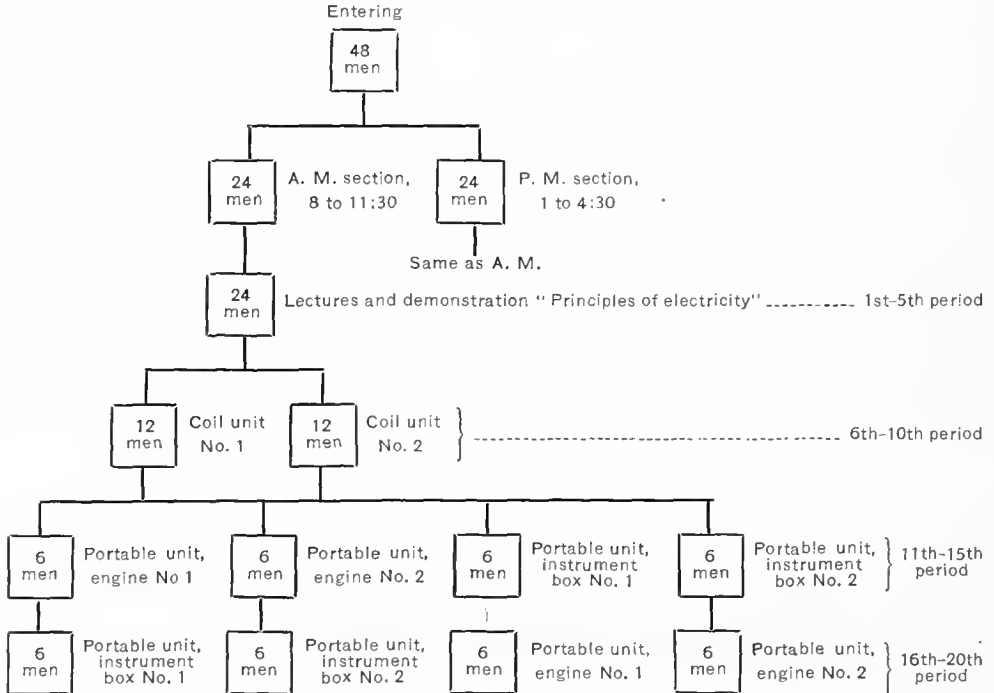
Manipulator's school schedule

	Machine course: Electricity and coil units		Machine course: Portable units		Developing and dark room		Position and exposure drill	
	8 to 11.30 a. m.	1 to 4.30 p. m.	8 to 11.30 a. m.	1 to 4.30 p. m.	8 to 11.30 a. m.	1 to 4.30 p. m.	8 to 11.30 a. m.	1 to 4.30 p. m.
First week.....	A	B			B	A		
Second week.....	B	A			A	B		
Third week.....			A	B			B	A
Fourth week.....			B	A			A	B

Section A, 24 men; section B, 24 men.

MACHINE COURSE

(Capacity: 48 men every two weeks, or 96 men per month)



SCHOOL OF ANATOMY

The school was authorized by the Surgeon General on the receipt of the following letter:¹⁵⁶

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., July 6, 1918.

From: Maj. A. S. Begg, M. R. C.

To: The Surgeon General of the Army, Washington, D. C. (through the commandant, medical officers' training camp).

Subject: Proposed School of Anatomy.

It has become evident that for the proper conduct of the professional schools at this camp it is now necessary to carry on certain instruction in anatomy. This is especially true as regards the specialties, in which at the present time individual attempts are being made to supply the needed instruction. After conference with the heads of certain special courses it is proposed to correlate and centralize this fundamental teaching.

In order to carry out the above program it is necessary to provide space, apparatus teaching material, and instructors. The commandant of this camp, in conference, pointed out the inadvisability of such an establishment within the reservation, and further inquiry elicited the fact that excellent quarters would be supplied by the University of Chattanooga, without cost to the Government.

Lieut. Robert J. Cook, M. R. C., now attached to instruction staff, is competent to assume charge of the work. The necessary additional instructors are also available, as is the necessary technical help, the latter being enlisted personnel.

The anatomical material can be obtained through the Tennessee authorities.

To properly carry out the above program, and begin at the earliest possible moment, it is requested that authority be granted to expend the sum of \$400 as follows: Construction of storage facilities, \$200; immediate purchase of chemicals, glassware and tools, \$200.

The cost of anatomical material not being determined, and the purchase of emergency supplies from time to time being necessary, it is further requested that the sum of \$200 per month be appropriated for this purpose.

It is recommended that authority requested above be communicated by telegraph.

* * * * *

A. S. BEGG.

[First indorsement]

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., July 6, 1918.

To the SURGEON GENERAL OF THE ARMY,
Washington, D. C.

Forwarded.

1. Approval recommended.

2. The proposed course in anatomy is essential for the full efficiency of the courses in surgery, orthopedic surgery, eye, ear, nose, and throat, genitourinary work and other specialties.

3. It would appear inadvisable to do any anatomical dissection in this reservation, in view of the undesirable impression sure to be made among the great number of recruits here. Having it conducted in Chattanooga, readily accessible by motor and trolley, removes these difficulties. The anatomical facilities which it is proposed to occupy were formerly used by the old Chattanooga Medical College, now defunct, for the present purpose.

4. Requisition for the necessary post-mortem instruments have been forwarded.

E. L. MUNSON,
Colonel, M. C., Commandant.

The school was originally intended to be only an integral part of the School of Military Surgery, but eventually almost every special professional school included a certain allotted time devoted to instruction in anatomy which was given at this school.¹⁵⁷

The location of the school was the first consideration. Through the efforts of the director, the laboratory of the medical department of the University of

Chattanooga, was secured for this work and a survey of the premises made. Dissecting tables were constructed, shelves and boxes prepared for the keeping of material, arrangements made with the medical supply officer for supplies to be used and for the purchase of anatomical material and emergency supplies which could not be obtained through the Quartermaster Department. An appropriation of \$200 per month was secured from the Surgeon General's Office. Later it was evident that this appropriation was too small and a larger one, of \$1,000 per month, was obtained.¹⁵⁷

Arrangements were made with Vanderbilt University to furnish material for dissection and operative work.¹⁵⁷ State laws in regard to obtaining material from the penal and charitable institutions of this vicinity were investigated, and it was found that there is an act in Shannon's Code of Laws for the State of Tennessee whereby anatomical schools are to receive unclaimed bodies from penal and charitable institutions. This was taken up with the authorities of the county and a number of bodies were received from that source. As there were so many student officers to go through this school and the scarcity of material prevented at least some of the men from doing work on the cadaver, it was apparent that it would be necessary, if every man was to have an opportunity of getting some applied operative work, to make available for them some other means. An operative and experimental course of operative surgery on the living dog was suggested. Preparations were then made, tables built, the room prepared for this work, and arrangements made to issue an order that all dogs running loose at Fort Oglethorpe should be caught for this work.

Instructors were selected for conducting this course, and from the first class in the School of Anatomy, beginning August 17, additional instructors were chosen to help conduct the work for the following class, and as each class passed through this school the best men were chosen for work with each succeeding class. To prevent the constant changing of instructors, as men were ordered to other camps, permanent instructors were assigned to the school.

The organization of a course of study whereby the student officers of the School of Military Surgery would be able to get a review of anatomy and of applied surgery as it was practiced in the war zone was perfected. A syllabus of anatomy which was to be covered by lectures, followed by demonstrations on dissected material of the regions covered by anatomy and surgical anatomy, was compiled. This course was of six days' duration. The general plan of this work on the cadaver was to divide the men in groups of 10 for each cadaver. A schedule of operations was arranged so that, by subdividing this group of 10 men into 2 groups of 5 each, one group working on the right and one on the left side of the body, in a region far enough removed not to interfere with the other group, there was very little confusion, and as the group working on either side finished an operation in the regions of the head or neck, this group was moved to the opposite side and an operation was performed on a lower extremity. Work was thus available in practically every region for every man. In their work on the cadaver, a study of the anatomy of each particular region was insisted upon and gone into in detail by the instructors assigned to this group. Owing to the scarcity of material, student officers from the different schools utilized every part of the body. The oral-plastic surgeons conducted

their course first. This was followed by classes from the School of Military Surgery, the School of Orthopedic Surgery, the School of Neurosurgery, the School of Otolaryngology, the School of Ophthalmology, and the School of Dentistry.

The following is a brief résumé of work accomplished month by month: ¹⁵⁷ Beginning August 17, 1918, a series of lectures of three days' duration was given to the class of surgery, consisting of 79 men. The work included a review of applied surgical anatomy and demonstrations of prepared specimens, skeletons, and charts. Seventeen men from this class and six men from the staff of General Hospital No. 14 were given a three-day course in operative surgery on the cadaver. After this class had finished, class No. 10, from the orthopedic school, numbering 30 men, was given a course in operations on the extremity and spine, which lasted for two days and was followed by a dissection of the extremities and back, extending over a period of eight days. Ratings of the class of the School of Military Surgery and of the class of orthopedic surgery were submitted to the directors of the respective schools at the end of the course. During the month of August 7 cadavers were obtained, only 3 of which were used, leaving 4 on hand to begin the work for the month of September.

During September a course of lectures and demonstrations of five days' duration was given to 114 men from the School of Military Surgery; of this number, 46 men were given a course of operative surgery on the cadaver and 26 men were given a course of operative surgery on the dog. In addition to this, 20 student officers from the School of Orthopedic Surgery were given a course of five days' duration, and 27 men from the School of Otolaryngology used the remaining available material for performing operations on the ear, nose, and sinuses. Four cadavers were used this month and four more were ordered from Nashville. Arrangements were perfected whereby the pauper dead of Hamilton County would be taken over for use in the school, and one body was received from the county. Five dogs were used this month for operative purposes.

The work for the month of October, on the same plan, was given to two classes from the School of Military Surgery, the first class numbering 77 men and the second class 134 men. All members of the first class were given an operative course of surgery on the cadaver and an additional 30 men were given an operative course on the dog; 6 dogs being used for this purpose. Of the second class in the month of October, 37 were given an operative course on the cadaver and 37 other men from this class were given a course in operative surgery on the dog. In this work, instrumental technique was insisted upon and the men were carefully rated by practical daily, oral and written quizzes on all work covered by lectures and demonstrations of dissected material and by operations on the cadaver and the dog. From the School of Orthopedic Surgery, during the month of October, the classes numbering 17 and 13 men, respectively, were given their course according to the plan adopted for orthopedic work. The first class devoted one week's time to the study of regional anatomy, and the second class, two weeks. Twenty-seven student officers from the School of Otolaryngology devoted three days to the study of regional

anatomy and operative work on material which had previously been used for the Schools of Surgery and Orthopedies. Nine student officers from the School of Plastic and Oral Surgery spent one day in the performance of plastic surgery about the head and one day for the performance of operations on the dog. Twenty-five student officers from the School of Dentistry spent one day in the performance of operations about the jaw and in the study of regional anatomy. Four bodies were received from the local county officials for the work during this month.

In the month of November, a class from the School of Military Surgery, numbering 83 men, reported on November 4. The general plan of lectures and demonstrations and ratings of one week's duration was given to this class and material was available for all members for operative work on the cadaver and the dog; 12 dogs being used for the purpose. On November 18 another class from the School of Military Surgery, numbering 102 men, reported and were given the same work, with the exception that no dogs were available for operative work for this class; however, every member was given work on the cadaver. From the School of Orthopedic Surgery, three classes, totaling 37 men, were given work and material on the plan adopted for the orthopedic classes. From the School of Otolaryngology, 10 men used material for operations and the study of regional anatomy. From the School of Plastic and Oral Surgery, 35 student officers spent 5 days here, 2 days of which were taken up by lectures and demonstrations and 3 days in the performance of plastic and surgical operations about the head and face. Nineteen student officers from the School of Dentistry spent two days in operative work on the cadaver and dissection of muscles, nerves, and vessels of the face. Twenty-five student officers from the School of Ophthalmology were given four hours of lecture and demonstration of dissected specimens of the brain, spine, cranial nerves, and contents of the orbit, and three hours operative work on the cadaver. Fourteen student officers from the School of Neurosurgery spent three days in the performance of operative work and dissection on the cadaver and experimental work on one live dog. During the month, the school received 3 bodies from the local and county officials and 12 bodies from Vanderbilt University at Nashville, Tenn. Only 13 of these bodies were utilized in the work, leaving 2 remaining for the work in December.

One hundred and fifteen student officers from the School of Military Surgery reported on December 2, and were given a 10-day course of lectures and demonstrations of dissected material, and operative surgery on the cadaver and the dog, eight cadavers and nine dogs being utilized in this work. Fifteen student officers from the School of Orthopedic Surgery followed out their general plan of work for two weeks, beginning December 2. Material was furnished to 80 men from the School of Dentistry for operative work and dissection in their particular region. Twenty-four student officers from the School of Otolaryngology used material for operative work on the sinuses, nose, and throat and for dissection in those regions. Fifteen student officers from the School of Plastic and Oral Surgery utilized material for the performance of plastic operations about the face. Fifteen student officers from the School of Neurosurgery spent three days here, one of which was devoted to experimental work on the live

dog and the other two on dissection of cadaver material. Sixteen student officers from the School of Ophthalmology spent one day in demonstrations and dissections and operative work pertaining to their particular region. During the month, 8 cadavers and 10 dogs were used for operative work by the different classes. On December 16, 49 student officers from the School of Military Surgery reported for a series of lectures in a review of anatomy, and 9 student officers from the School of Orthopedic Surgery reported for work in their branch of surgery. On December 17 orders were received to discontinue work in the special courses to men who had been ordered to these schools subsequent to December 10; consequently the courses were discontinued.¹⁵⁷

The following is the schedule of lectures and demonstrations:¹⁵⁷

Monday:

- A. m.----- Scalp and skull as a whole; face and neck.
P. m.----- Demonstration of above.

Tuesday:

- A. m.----- Thorax and diaphragm; shoulder, arm, foreman, and hand.
P. m.----- Demonstrations of above.

Wednesday:

- A. m.----- Pelvis, hip, thigh, knee, and leg; vertebral column and spinal cord.
P. m.----- Demonstrations of above.

Thursday:

- A. m.----- Abdominal wall, peritoneum, gastrointestinal tract, and fixed abdominal organs; genitourinary tract.
P. m.----- Demonstrations of above.

Friday:

- A. m.----- Blood and vascular system; landmarks and ligations.
P. m.----- Quiz.

Saturday:

- A. m.----- Quiz and written (final) examination.

OPERATIVE COURSE ON THE CADAVER

RIGHT SIDE

First day:

- 10 to 10.30----- Lumbar puncture—landmarks.
10.30 to 11.15----- Subtemporal decompression.
11.15 to 12----- Ligation of posterior tibial artery in middle third of leg and at the bend of the ankle.
1 to 1.45----- Lumbar nephrectomy.
1.45 to 2.45----- Ligation of femoral artery, followed by dissection of Scarpa's triangle.
2.45 to 3.30----- Ligation of brachial artery at middle third of arm and exposure of musculospiral nerve.

Second day:

- 10 to 10.45----- Guillotine amputation of foot anterior to the tibialis anticus and peroneus longus.
10.45 to 11.15----- Guillotine amputation of upper third of forearm.
11.15 to 12----- Guillotine amputation of lower third of thigh. Study of cross section of each.
1 to 1.45----- Blocking of second and third divisions of fifth nerve—landmarks.
1.45 to 2.15----- Ligation of external carotid artery—landmarks and relations.
2.15 to 3.30----- Dissection of perineum.

Third day:

- 10 to 10.30----- Tracheotomy (high and low).
- 10.30 to 11.15---- Splenectomy.
- 11.15 to 12----- Removal of foreign body from prevertebral space following posterior border of sternomastoid muscle.
- 1 to 2----- Repair of injury to diaphragm in the costophrenic sinus.
- 2 to 2.45----- Exploratory incision for gunshot wound of the abdomen.
- 2.45 to 3.30----- Ligation of the anterior branch of the middle meningeal artery.

Fourth day:

- 10 to 10.30----- Exploratory incision and suture of wound of liver.
- 10.30 to 11.15---- Osteoplastic flap over motor area and tapping for lateral ventricle.
- 11.15 to 12----- Pericardial paracentesis and explorations.

LEFT SIDE

First day:

- 10 to 10.30----- Lumbar puncture—landmarks.
- 10.30 to 11.15---- Ligation of popliteal artery and dissection of popliteal space.
- 11.15 to 12----- Laminectomy—eighth, ninth, and tenth thoracic.
- 1 to 1.45----- Suture of sciatic nerve in middle of thigh.
- 1.45 to 2.45----- Ligation of axillary artery followed by dissection of axillary space.
- 2.45 to 3.30----- Ligation of the anterior tibial artery and exposure of anterior tibial nerve.

Second day:

- 10 to 10.45----- Guillotine amputation at the wrist joint.
- 10.45 to 11.15---- Guillotine amputation at upper third of leg.
- 11.15 to 12----- Guillotine amputation of arm (supracondylar).
Study of cross section of each.
- 1 to 1.45----- Blocking of second and third divisions of fifth nerve—landmarks.
- 1.45 to 2.15----- Extraperitoneal ligation of internal iliac artery.
- 2.15 to 3.30----- Dissection of parotid gland, facial nerve and parotid portion of external carotid artery.

Third day:

- 10 to 10.30----- Suprapubic cystotomy.
- 10.30 to 11.15---- Ligation of third portion of subclavian artery—relations.
- 11.15 to 12----- Transperitoneal nephrectomy.
- 1 to 2----- Exposure of cervical brachial plexus—relations.
- 2 to 2.45----- Ligation of lingual artery—relations.
- 2.45 to 3.30----- Herniotomy (Andrew's method).

Fourth day:

- 10 to 10.30----- Ligation of posterior branch of middle meningeal artery—landmarks.
- 10.30 to 11.15---- Thoracotomy. Resection of rib, evisceration and repair of lung wound.
- 11.15 to 12----- Ligation of facial artery and complete dissection of side of face.

COURSE IN OPERATIVE SURGERY ON THE DOG

First day:

1. Blood transfusion, citrate method; typing blood.
2. Arterial suture (femoral artery) for injury to vessel wall.
3. Resection of the intestine, with end to end anastomosis, Connell stitch.
4. Splenectomy for hemorrhage, with discussion of danger points.
5. High tracheotomy.
6. Evisceration of the lung, with mattress suture to control hemorrhage; intratracheal insufflation anesthesia.
7. Subtentorial decompression.
8. Guillotine amputation of the thigh, with quiz on cross section.

Second day:

1. Lateral anastomosis of the small intestine.
2. Enterorrhaphy for penetrating wounds of intestines and stomach.
3. Suture for liver hemorrhage, using omentum and rectus muscle.
4. Transabdominal nephrectomy for hemorrhage.
5. Lumbar nephrectomy.
6. Suprapubic cystotomy.
7. Pericardiorrhaphy for stab wound or foreign body.
8. Decompression of Rolandie area.

Demonstrations were given of the following: Bones of head and face; head, trepanation landmarks, arteries, and motor area; base of skull; dura mater and sinuses; lateral and medial surface of brain; base of brain; facial nerve and artery, parotid gland, Steno's duct, superficial structures and triangles of neck; branches fifth nerve, landmarks for blocking internal maxillary artery; sagittal section, skull and face; deep vessels of neck and branches; nerves of neck; pharynx, larynx, trachea, and esophagus; cross section of neck at base of skull; cross section root of neck; sympathetic nerve system; spinal cord; osteology of spinal column; osteology of the upper extremity as a whole; brachial plexus; axillary space; shoulder joint, muscles, and ligaments; elbow and wrist joints and ligaments; muscles and nerves and vessels; muscles of forearm; nerves and vessels of forearm; muscles, nerves, and vessels of hand; musculospiral, median, radial, and ulnar nerves, with vessels; lungs and pleura; heart and pericardium; diaphragm and aorta; intestinal tract and fixed organs; viscera of pelvis and internal iliac artery; ligaments around pelvis and hip; ligaments of knee and ankle joint; hip flexors; nerves and vessels of thigh; nerves and vessels of leg and foot.

OPERATIVE COURSE IN ORTHOPEDIC SURGERY

Tenotomy of tendo Achillis.

Tendon lengthening—open method.

Removal bone-graft from shaft of tibia—save for Albee operation.

Astragalectomy—as a foot stabilizer.

Transplantation of peroneals to act as dorsal flexors of foot.

Knee—anterior median incisions—removal of portion of external semilunar cartilage.

Dislocation of patella—use of ligamentum patellæ to prevent.

Transplantation biceps and semimembranosus or sartorius.

Fasciotomy of hip for hip flexion contracture.

Osteotomy lower end of femur.

Nerve suture—sciatic, musculospiral, brachial plexus.

Tendon fixation at ankle.

Arthroplasty at hip.

Fracture of humerus with bone splinting.

Arthrotomy of shoulder.

Excision of bones of wrist.

Resection of elbow joint—subperiosteal.

Laminectomy.

Hibbs spine operation or Albee.

Drainage of osteomyelitis.

Transplantation of triceps.

Transplantation pronator radii teres.

Dissection of extremities and back.

Number of men belonging to the different classes that passed through the School of Anatomy:¹⁵⁷

School of Military Surgery.....	704
School of Orthopedic Surgery.....	132
School of Dentistry.....	124
School of Otolaryngology.....	88
School of Plastic and Oral Surgery.....	59
School of Ophthalmology.....	41
School of Neurosurgery.....	29
Total.....	1, 177
Number of cadavers used.....	45
Number of live dogs used.....	45

LABORATORY SCHOOL

This school was ordered established by the following letter:¹⁵⁸

JANUARY 19, 1918.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: School for training of laboratory specialist officers.

1. A school for the training of medical officers as specialists in laboratory work will be established as part of the general scheme of instruction carried out in the Medical Officers' Training Camp, Fort Oglethorpe, Ga.

2. The purpose of this school is to train medical officers for laboratory work by military methods for military purposes; and coincidently to develop them physically and train them in subjects which they should know under the conditions under which they would practice their specialty, including organization, paper work, applied military hygiene and sanitation, handling of enlisted men, and general functions as officers.

3. Classes will be arranged on a basis of a two months' course.

About 20 officers trained as laboratory officers will be required monthly.

It is proposed to supply the entire needs for laboratory workers for the Army through this school.

4. The school for the training of laboratory workers will serve as the department laboratory, Southeastern Department, and perform all the duties heretofore devolving on the latter.

5. The school for the training of laboratory workers will affiliate with the base hospital, and receive advantage of its facilities, for all necessary professional purposes.

For research work, testing of apparatus, training of special men and similar purposes, it will also affiliate with the Camp Greenleaf School of Applied Hygiene and Sanitation.

6. The general professional instruction to be given will relate to laboratory methods and technique as adapted to military conditions and purposes.

7. It is intended to erect a laboratory building convenient to the general hospital, removing thereto all personnel and equipment of the department laboratory now at Atlanta.

This laboratory will serve the functions of—

(a) Laboratory for the general hospital.

(b) Department laboratory.

(c) Training school for laboratory workers.

8. (a) The senior instructor for this school detailed by this office on the staff of instructors of the training camp will, under the commandant thereof, be in direct charge of the course.

(b) He will continuously investigate the qualifications and suitability for laboratory service of medical officers, and others, under instruction.

(c) As director of the department laboratory, and for all laboratory work other than that of training, he will be responsible directly to this office.

9. It is intended to construct barracks for 100 medical officers and for 100 enlisted men under instruction in this school.

These barracks will be part of the medical officers' training camp.

10. Officers under training in this course will be organized as a special company, be quartered in the medical officers' training camp, and be subjected to its discipline at all times.

11. Hours of instruction, participation in joint classes, etc., will be arranged by the commandant of the training camp.

12. The schedule for the first month will be as follows:^b

* * * * * *

SPECIAL SUBJECTS

The details of this part of the course, including organization, equipment, supply, use, and administration of fixed and mobile laboratories, will be arranged by you, after conference with the officer assigned by this office in charge of the course; 56 hours.

14. Following the basic instruction given in the first two months as above, special training over a variable period of time will be continued by personnel under instruction.

It is contemplated to keep a reserve under training at all times, and for such periods as their services may not be required elsewhere.

This special training will be prescribed by the officer in immediate charge of instruction under this course.

15. A number of selected enlisted men of the Medical Department, not exceeding 100 at any one time, will be kept at your camp under instruction. They will be organized as a special company and be under the discipline of the training camp at all times.

All such will be given such part of the basic course for enlisted men at your camp as might be of advantage to them in such service.

The scope of their special training in laboratory work, to be given during the first two months of training, will be prescribed by you after conference with the officer designated as in direct charge of the work.

16. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON,
Colonel, Medical Corps.

In carrying out the instructions given in this letter, a school for bacteriology and pathology specialists and a school of pathology were established,¹⁵⁹ constituting the laboratory school. The school progressed very slowly, the accommodations allotted being limited and providing for a class of only 10 officers and 20 enlisted men.¹⁶⁰ In July the school was closed for a while, as there were no student officers to instruct.¹⁶¹

In October, 1918, the school was moved to another building, occupying one complete company barrack. This gave ample space for the instruction of all the officers assigned and also for 60 enlisted technicians monthly. When the armistice was signed the school was well under way with a full quota of students. Unfortunately, as most of the enlisted men were medical students, they were discharged shortly after the armistice by orders from the War Department.

A complete syllabus was compiled when the laboratory school was first started, and instruction was carried on according to this.¹⁶² The following schedules show in detail how the instruction for each week was divided.^{163 164}

^b See pp. 78, 79.

Laboratory course for student officers, July 2 to 31, 1918

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 11.30 a. m.	Pathology	Clinical microscopy	General bacteriology	Clinical microscopy	Vaccine therapy	Serology
1.30 to 4 p. m.	Biological chemistry	General bacteriology	Serology	Biological chemistry	Epidemiology	

Laboratory course for enlisted men, July 2 to 31, 1918

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 11.30 a. m.	Lectures and practical work in bacteriology	Lectures and practical work in the preparation of culture media	Lectures and practical work in blood examinations	Lectures and practical work in urinalysis	Lectures and practical work in bacteriology	Lectures and practical work in Government property
1.30 to 4 p. m.	Lectures and practical work in the collection of specimens for laboratory examination	Lectures and practical work in urinalysis	Lectures and practical work in feces examination	Lectures and practical work in the collection of specimens for laboratory examinations	Lectures and practical work in feces examination	

Laboratory schedule for course of instruction for enlisted men, November 25, 1918

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 11.30 a. m.	Bacteriology	Bacteriology	Serology	Parasitology	Bacteriology	Bacteriology
1.30 to 4 p. m.	Clinical microscopy	Chemistry	Clinical microscopy	Chemistry	Clinical microscopy	

SCHOOL OF NUTRITION

The following letter directed the organization of a school of nutrition at Camp Greenleaf: ¹⁶⁵

MARCH 7, 1918.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: School for officers of the division of foods and nutrition, Sanitary Corps.

1. A school for officers of the division of foods and nutrition, Sanitary Corps, will be established as part of the general scheme of instruction carried out in the Medical Officers' Training Camp, Fort Oglethorpe, Ga.

2. The purpose of this school is to conduct the training of these officers of the Sanitary Corps along military lines, from the military viewpoint, and in the military environment; and coincidentally to develop them physically and train them in subjects which they should know under the conditions under which they would practice their specialty, including organization, regulations, paper work, relations with enlisted men, and their general functions as officers.

3. About 20 graduate food experts of the sanitary division are required monthly.

Classes should be arranged on the basis of a course lasting two months.

4. The senior instructor for this school, detailed by this office on the staff of instructors of the training camp, will, under the supervision of the commandant thereof, be in direct charge of the course.

In addition to his educational duties, he will continuously investigate the qualifications and suitability of officers and enlisted men under instruction.

5. The routine of all matters relating to food, messing, and nutrition in the various organizations at your camp will, as far as possible, be demonstrated and utilized as part of the subjects of instruction.

6. The general technical instruction to be given will relate to matters having to do with food and nutrition, and is briefly outlined in this letter of instructions.

The necessary details will be furnished by the food division, this office.

The course of instruction, based thereon, will be prescribed by the commandant, medical officers' training camp, after conference with the senior instructor of the school.

7. The course in general training, together with food work, will cover a minimum of two months. That part of the course relating to food work will comprise a total of 110 hours.

8. Officers under training as specialists in food and nutrition work will be organized as a separate organization or detachment, will be quartered and subsisted in the medical officers' training camp, and be subjected to its discipline at all times.

9. Hours of instruction and participation in joint courses will be arranged by the commandant of the training camp.

10. The schedule of the first month is as follows: ^b

*	*	*	*	*	*	*
SPECIAL						Hours
The principles of nutrition.....						20
The physiology of digestion.....						5
Food economy.....						5
Total.....						30

11. The schedule of the second month is as follows: ^b

*	*	*	*	*	*	*
SPECIAL						Hours
Composition of foods.....						10
Fundamentals of mess cooking.....						15
Food inspection.....						20
Mess accounting.....						5
Mess management.....						10
Nutritional surveys.....						20
Total.....						80

12. A number of enlisted men will be kept at your camp under training to assist in food work. This number will be later announced.

All should be given such part of the basic course of enlisted men at your camp as might be of advantage to them in such service. The score of their special training in food work will be prescribed by you after conference with the senior instructor in charge of the course in food work.

13. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON,
Colonel, Medical Corps.

Before this school was established according to these instructions, the division of food and nutrition was communicated with and asked to present a memorandum outlining the special features of such a course.¹⁶⁶

^b See pp. 78, 79.

The following syllabus was the result of this correspondence:¹⁶⁷

SYLLABUS OF INSTRUCTION COURSE FOR NUTRITION OFFICERS AT CAMP GREENLEAF

I. COMPOSITION OF FOODS

(Fifteen lectures of one hour each; textbook, Sherman's Food Products)

1. Definition of food; essential elements (protein, fat, carbohydrates, mineral salts, accessories, water); caloric value of food elements.
2. Milk; evaporated milk; dried milk; reconstructed milk (homogenizer and emulsor); skimmed milk.
3. Dairy products (other than milk) and eggs (cream, cheese, buttermilk, ice cream); eggs (cold storage, frozen, dried).
4. Meat and meat products (meat, poultry, fish, shellfish); fresh, cured, refrigerated, frozen, dried, canned, dehydrated.
5. Bread and flour; grades of wheat flour; flour substitutes (sweet-potato flour, cottonseed flour, soy-bean flour, alfalfa flour, peanut flour).
6. Cereal products; breakfast foods; alimentary pastes; package versus bulk cereals.
7. Vegetables; high-protein starch; canning, preserving, drying dehydration; extent of canning industry.
8. Fruits and nuts; canning, preserving, drying; importance of fruit acids.
9. Edible fats and oils (butter, oleomargarine, nut margarine, nut butters, lard and lard substitutes, cottonseed oil, olive oil, coconut oil, corn oil, peanut oil, soy-bean oil).
10. Saccharine products (cane sugar, beet sugar, invert sugar, maple sugar, honey, molasses, sirups, glucose, jam, jelly, preserves, marmalade).
11. Coffee, tea, cocoa, and chocolate.
12. Soft drinks (cola preparation, near beers, pops, so-called tonics).
13. Spices and condiments (vinegar, ketchup, pickles, salt, extracts).
14. Food preservatives, their use and abuse (salt, vinegar, smoke, benzoic acid, boric acid); prohibited preservatives (formaldehyde, salicylic acid, sulphites, phenol, abradol, formic acid, fluorids); artificial sweeteners (saccharin, dulcin, etc.); artificial colors (mineral, vegetable, coal-tar).
15. Confectionery.

To be supplemented by charts and samples of pure and adulterated foods.

II. THE PHYSIOLOGY OF DIGESTION

(Major Carlson's lecture, Howell's Physiology)

	Hours
1. The motor phenomena of the alimentary tract, nervous control of.....	1
2. The sensations of the alimentary tract (flavor, appetite, hunger) and the nervous control of secretions.....	1
3. Digestion in the stomach.....	1
4. Digestion in the intestines.....	1
5. Absorption and utilization of food.....	1
(Diagrams of alimentary tract.)	

III. THE PRINCIPLES OF NUTRITION

(Textbook, Lusk's Science of Nutrition—part)

1. Calorimetry, direct and indirect.....	3
2. Fasting as a basis of nutritive requirements.....	2
3. The maintenance of body temperature as a basis of energy requirements.....	2
4. The influence of protein on metabolism.....	3
5. The influence of fat on metabolism.....	1
6. The influence of carbohydrate on metabolism.....	2
7. The influence of muscular work on metabolism.....	1
8. What is the normal diet.....	2
9. The accessory substances in the food.....	1
10. Food requirements for growth.....	2
11. Food economics.....	1

(Charts: Milner apparatus; bomb calorimeter; standard portions).

IV. FUNDAMENTALS OF MESS COOKING

(The Manual for Army Cooks)

1. The rations of the United States Army; rations of different allied armies.....	1
2. Construction of menus or bills of fare; ration balancing; a mechanical device for checking the proper distribution of nutrients.....	3
3. Kitchen equipment for permanent camps and for field service.....	2
4. Actual experience in kitchen, as kitchen police, assistant cook, and cook.....	10
(Set apart a kitchen especially for food division which will be a model in every respect.)	

V. MESS MANAGEMENT AND ACCOUNTING

(Manual for Army Cooks and Manual for Mess Officers)

1. Mess sergeant's duties, actual experience in mess accounting.....	3
2. Mess officer's duties, actual experience.....	3

VI. PROTECTION OF FOOD AGAINST SPOILAGE AND DETERIORATION

1. The general phenomena of spoilage; fermentation, putrefaction; causes.
2. Cold storage; applicability, principles involved, results.
3. Dehydration; applicability, principles, results, microbic survivors.
4. The use of preservatives; salt, sugar, smoke, etc.; Pasteurization.
5. Sterilization by heat; canning, intermittent heating, cold pack, etc.

VII. FOOD INSPECTION

(Leach's Food Inspection and Analysis)

- A. Didactic:
 1. Inspection of vegetables and vegetable products, molds, rots, etc.
 2. Inspection of breadstuffs, cereals, rice, etc.
 3. Inspection of beef, hams, and other fresh or cured meat products.
 4. Inspection of canned goods, milk, fruits, meats, vegetables.
 5. Inspection of vinegar, ketchups, etc.; five hours laboratory demonstration.
- B. Practical:
 1. Inspection of quartermaster stores at camps adjacent; five hours.
 2. Inspection trips to refrigerators and storage warehouses in Chattanooga.

VIII. NUTRITIONAL SURVEYS

(Orders to party leaders)

- A. Didactic:
 1. Purpose of nutritional surveys: To study food consumption; to study food waste.
 2. Relations with officers of the camp (commanding officer, division surgeon, sanitary inspector, regimental surgeon, company commanders, mess officers).
 3. Methods employed; inventories; accession to stock; methods of weighing.
 4. Separation of garbage and reclamation; weighing and sampling; standards to be enforced (?).
 5. Computation of food consumption and waste.
- B. Practical:
 1. Application of methods to individual messes in actual surveys.
 2. Possibly start a piggery. Weigh garbage and weigh animals.

This school was started September 3, 1918, according to the instructions received, and the special nutritional instruction was based on the above syllabus. Some instruction along this line had been given since June 1, 1918. Naturally, this being a new method of teaching nutritional work, many changes in subjects and methods of instruction, even in the short life of the school, were made.^{168 169 170}

It was found that the time allotted to this instruction was entirely too short and on that account the officers were not sufficiently prepared before leaving the school. This condition of affairs called forth the following:¹⁷¹

SCHOOL OF NUTRITION, CAMP GREENLEAF,
Chickamauga Park, Ga., November 4, 1918.

From: Capt. R. J. Anderson, Sanitary Corps.

To: The Surgeon General, United States Army, Washington, D. C.

(Attention Lieutenant Colonel Murlin, through commandant).

Subject: Improving the course of instruction for nutrition officers.

1. In addition to the basic course of instruction given in this school, it would seem that some more practical work along the lines of nutrition in the Army would be very desirable, before our officers are sent to permanent posts. In this connection I would suggest, after completing the basic course, which includes a review of the composition of foods, physiology of digestion, metabolism, principles of nutrition, mess and food inspection, waste studies, and nutritional surveys, as outlined in my letter of October 1, 1918, that our men be detailed as assistants to mess officers in the various units in this camp. I believe that arrangements could be made through the commandant with the various organizations such as the hospital, medical officers' training camp, or training battalions to place officers from this school on duty with the mess officers in the different units mentioned above.

2. An extension of the work of student nutrition officers as suggested above would necessitate that their stay in this camp was prolonged possibly two weeks. If this extension of the time of training can possibly be arranged, I think that it would be well worth while in view of the greater experience that the officers would receive. At the end of the additional training they would have a more intimate knowledge of mess conditions and the problems connected with the handling of messes, menus, and mess accounts than it is possible for them to obtain under present conditions.

3. If necessary I will endeavor to cut the time of the basic course to four or five weeks. Then the men will be placed as assistants to the food inspector which we hope to establish and following that they will act as assistants to mess officers. The proposed time arrangement will be as follows: Military training, 2 weeks; basic school course, 5 weeks; food inspection, one-half week; mess officer, 1 or 2 weeks.

4. Please let me know if this plan meets with your approval so that necessary arrangements may be made with the camp authorities for the extension of our work.

R. J. ANDERSON,
Senior Instructor, School of Nutrition.

[Second indorsement]

SGO 353 Nutrition, Camp Greenleaf.

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE,
November 11, 1918.

To Capt. R. J. ANDERSON,
*Sanitary Corps, Nutrition School,
Camp Greenleaf, Chickamauga Park, Ga.
(Through commandant).*

1. The plan for giving more practical work to the students at the School of Nutrition is approved. By reason of the urgent demand for officers, it may not be possible in all cases to extend the time of training by two weeks, and it is thought that the suggestions conveyed in paragraph 3 "to cut the time of the basic course to four or five weeks" would be wise.

By direction of the Surgeon General:

CASPAR W. MILLER,
Major, Medical Corps, Division of Food and Nutrition.

Unfortunately for this instruction, the school was closed December 12, 1918,¹⁶⁸ only a short time after this letter was written and the authority asked for therein received. Fifty officers received instruction in this school.¹⁶⁸ The

instruction which was given just before the final closure of the school was divided into three periods:¹⁷⁰

First period (two weeks).—On arrival in camp the new officers were assigned to one of the companies in Battalion 11 and received the general instruction given to all officers of the medical officers' training camp, consisting of about four hours of military drill per day and the remainder of the time studying Army Regulations, Manual for Courts-Martial, etc., and attending the general lectures for all officers of the group. A quiz period of one to two hours per day was held to cover the work of the previous day.

Second period (two weeks).—At the beginning of the third week the student officers were relieved from afternoon drill and from the attendance upon the general lectures and quizzes and reported to the School of Nutrition for their technical training in nutrition. Three or four introductory lectures were usually given, covering the work that nutrition officers would be expected to do, various problems that would confront them in different types of camps, and the general methods of going about the work to overcome difficulties. One or more lectures were given covering the organization and management of the Army mess, the duties of mess officers, and the position of the mess sergeant. The various members of the class were then assigned subjects upon which to report. These subjects covered different phases of the following general headings and usually in the order given: (a) Carbohydrates, their composition, sources, uses in the body, etc.; (b) proteins, composition, sources, uses in the body; (c) fats, composition, sources, uses in the body; (d) mineral constituents of foods; (e) vitamins, their importance in the Army diet; (f) acid-base balance of the ration.

The textbooks which were most used as sources of information by the students were the following: Chemistry of Food and Nutrition, by Sherman; Food Products, by Sherman; Physiological Chemistry, by Mathews; and The Science of Nutrition, by Lusk. Practically all the technical work given is taken up rather thoroughly in one or the other of these textbooks.

During the second two weeks of the course the work was quite theoretical, but no opportunity was overlooked to connect theory and practice. In addition to the work of the classroom, two or three half-day periods were devoted to mess inspections. Usually the student officers were grouped in pairs and each pair told to inspect two to four messes and write reports giving criticisms and suggestions for changes. Prior to the beginning of this work a lecture was given on how to properly inspect a mess, good and bad features to look for, and the methods to be used in getting changes made.

Another very important assignment during this period was to prepare an Army menu for 100 men for 10 days, giving the quantities of ingredients to be used in each dish. When completed, the ration for the 10-day period must not cost above the Government allowance and must be approximately balanced in protein, fat, and carbohydrates. There must also be sufficient calcium present, and the acid-base balance must be neutral or an excess in favor of the base. The preparation of this menu involved a lot of practical work and was one of the best methods of getting a new officer acquainted with just what an army menu should look like, and of course he then knew how to criticize the ones present in the messes that he inspected later.

Third period (two weeks or longer).—At the beginning of the fifth week of the course the students were relieved from all military duty and were assigned in groups of two to four to run waste studies on various messes in camp. Each group studied one particular mess for a given period, usually two to three days. The primary purpose of this work was to get the student intimately acquainted with a mess and to enable him to see how it was managed, how the cooking was done, etc. Incidentally, he got data on the amount and kinds of waste and learned how to reduce it to the minimum. Following the waste study, the party usually remained in the same mess for three to seven days longer to carry on a food survey. The following points are among the most important determined by the food survey: (a) Total calories consumed per man per day; (b) calories wasted per man per day; (c) number of calories derived from each of the three constituents, protein, fat, and carbohydrate; (d) cost of food per man per day; (e) cost of waste per man per day; (f) points of general criticism and suggestions for changes.

During the period of the food survey at least one of the students of the party was present in the mess at all times to get the weights of incoming supplies, weights of ingredients used in cooking, amounts of waste, and to note any items of interest. The constant contact with the mess operations was the only way to learn how a mess should be managed. If time permitted, at least two of these surveys were completed before the work of the student was complete.

The work was as well outlined as could be desired and gave a good combination of the theoretical and the practical. The men who passed through the school during the fall, almost without exception, knew the theoretical side of foods very well upon arrival in camp, but a large number of them, after completing the course and reporting for duty elsewhere, were handicapped because they were not thoroughly familiar with the practical side of different types of Army messes. Of course, it was impossible in such a brief time to give the new officer a thorough knowledge of military life and also to acquaint him with all phases of mess management. However, the aim was to emphasize the theoretical less and the practical more.

DENTAL SCHOOL

The Dental School was authorized by the following letter from the Surgeon General:¹⁷²

FEBRUARY 1, 1918.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga.

Subject: School for training officers of the Dental Corps.

1. A school for officers of the Dental Corps will be established as part of the general scheme of instruction carried out in the Medical Officers' Training Camp, Fort Oglethorpe, Ga.

2. The purpose of this school is to train officers of the Dental Corps along military lines, from the military viewpoint, and in the military environment; and, coincidentally, to develop them physically and instruct them in subjects which they should know under the conditions under which they would practice their specialty, including paper work, organization, relation to enlisted men, and general functions of officers.

3. Classes will be arranged on a basis of a course covering two months. About 80 trained dental surgeons will be required monthly.

It is intended that all newly appointed officers of the Dental Corps shall receive this course, together with such others as the needs of the service will permit of taking it.

4. The school for the training of officers of the Dental Corps will maintain and operate a dental clinic and dental laboratory for all the troops at Chickamauga Park, including the personnel of the general hospital, utilizing the clinical material available for purposes of practical dental instruction.

5. Where necessary, as for X-ray work, surgery of the face and jaws, and for other purposes, the school for officers of the Dental Corps will affiliate with other professional schools and courses maintained as part of the Medical Officers' Training Camp, Fort Oglethorpe.

6. It is intended to erect a special building for practical clinical and laboratory purposes relating to the dental service, as well as for instruction purposes.

7. The senior instructor for this school detailed by this office on the staff of instructors of the training camp will, under the commandant thereof, be in direct charge of the course.

He will continuously investigate the qualifications for the dental service of officers and others under instruction.

8. The general professional instruction to be given will relate especially to the care and treatment of the teeth and conditions dependent thereon.

9. Officers of the Dental Corps will be organized as one or more special companies, be quartered in the medical officers' training camp, and be subject to its discipline at all times.

10. Hours of instruction, participation in joint classes, etc., will be arranged by the commandant of the training camp.

11. The schedule for the first month is as follows: ^b

* * * * *

SPECIAL DENTAL SUBJECTS

Dental supply table; nature, care, and replenishment of supplies.

Motor dental ambulances; their equipment and management.

Dental laboratory organization; fixed and field.

Organization and management of department, division, and cantonment dental service.

Limitations of dental practice in the military service.

Practice of operative and prosthetic dentistry in the military service.

Minor dental oral surgery.

Conductive anesthesia.

Interpretation of radiographs.

Wound infections.

Other subjects not specified.

Total special subjects, 110 hours.

Time apportioned to each of the above special subjects to be fixed by the commandant, after conference with the officer in charge of the school for the Dental Corps.

13. The dental division will establish and maintain one or more mobile dental ambulances for purposes of training at your camp.

14. A number of enlisted men of the Medical Department will be maintained at your camp for training with a view to their assignment to duty as assistants to officers of the Dental Corps. This number will be announced later. It will probably be about the same as the number of dental surgeons under instruction.

All such should be given such part of the basic course for enlisted men as would properly form part of their general training for such special service. The scope of their special training in dental work will be prescribed by you.

15. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON,
Colonel, Medical Corps.

^b See pp. 78, 79,

The school was organized in March, 1918.¹⁷³ The first month of the instruction of dental officers consisted of the basic course given for medical officers. While dentists received a certain amount of instruction during this month that was perhaps not absolutely necessary, it was, in the main, excellent, especially as dental officers had been called upon frequently abroad to take the place of medical officers in the field, the instruction they had received during this first basic month, it is believed, making this possible. Universal satisfaction was expressed by dentists leaving camp because of the fact that they had received an introduction to the service and at least a slight knowledge of the operation of other branches.¹⁷⁴

The instruction to be given in the second month of training was as follows:¹⁷⁵

SECOND MONTH

FIRST WEEK

	Hours
Setting-up exercises, drills, and marches.....	10
Manual for Courts-Martial and Military Law.....	2
Sanitary service.....	1
Rules of land warfare.....	1
Duties of the dental surgeon.....	1
Dental supplies and supply table.....	1
Special subjects:	
Syphilitic lesions of the mouth.....	1
Baeteriology, general.....	2
Bacteriology, laboratory, practical.....	4
Inflammation, inception and termination; immunity, etc.....	2
Dental caries, theory of.....	1
Prosthetic dentistry, theory.....	1
Principles of surgical cleanliness, sterilization, etc.....	2
Anesthesia, local, general consideration, drugs used.....	1
Oral surgery, theory.....	2
X ray, theory.....	2
Root canals, pathology.....	4
Root canals, treatment.....	4
Root canals, filling.....	4

SECOND WEEK

Setting-up exercises, drills, and marches.....	10
Manual for Courts-Martial and Military Law.....	2
Rules of land warfare.....	1
Organization of Medical Department and hospitals.....	1
Special subjects:	
Theory of focal infection.....	2
Bacteriology, general.....	2
Bacteriology, laboratory, practical.....	4
Inflammation, special, dental.....	2
Prosthetic dentistry, theory, splints and wiring.....	2
Anesthesia, infiltration, and conductive, theory.....	2
Oral surgery, theory.....	4
X ray, theory.....	4
X-ray interpretation, practical.....	4
Apicectomy, theory.....	2
Exodontia, theory.....	2
Diseases of oral cavity.....	2

THIRD WEEK

	Hours
Setting-up exercises and drills.....	10
Poison gases, practical.....	2
Special subjects:	
Plastic surgery.....	2
Bacteriology, dental.....	2
Bacteriology, dental, laboratory, practical.....	4
Cavity preparation, (Blacks).....	1
Written examination (pathology, bacteriology, anesthesia, etc.).....	3
Dentistry, prosthetic, practical, splint making.....	4
Anesthesia, infiltration and conductive, practical.....	4
Exodontia, practical.....	Unlimited.
Apicoectomy.....	Unlimited.
General review.....	4
Written examination.....	4

FOURTH WEEK

Setting-up exercises, drills, and marches.....	10
Cavity preparation, practical.....	Unlimited.
Prosthetic dentistry, practical (splints and wiring).....	Unlimited.
Anesthesia, local, clinical.....	Unlimited.
Exodontia, clinical.....	Unlimited.
Root-canal treatment and filling, clinical.....	Unlimited.
X ray, clinical.....	Unlimited.

Under operative dentistry a rather extensive course was given in the proper treatment and filling of the canals of pulpless teeth and the proper preparation of cavity and filling material.¹⁷⁴ For all practical work the classes were divided into sections, and ample clinical material was furnished each student officer.

In oral surgery no effort was made to instruct students in the actual surgery of a given case, but rather in the prosthetic appliance the oral surgeon would probably need. In this the school was handicapped until the middle of the summer of 1918 because of lack of information coming from the hospitals in France regarding just what they had found to be good and what they had discarded. There had never been any adequate and comprehensive instruction along these lines, as never before had it been necessary, and the few mechanical appliances that had been described in the professional literature of the past were awkward and known to be inefficient for this emergency. However, late in the summer, the school began teaching the form of prosthesis that was being used in France; e. g., case silver, banding, wiring, etc.¹⁷⁴

In dental radiography the student officers were taught the practical operation of the X-ray machine and film interpretation.¹⁷⁴

Pathology consisted of lectures having to do with oral infections and placing particular stress on the theory of focal infection.¹⁷⁴

The school was closed December 24, 1918.¹⁰⁶

VETERINARY TRAINING SCHOOL

This school was organized February 15, 1918.¹⁷⁵ The first class consisted of 44 student officers. These officers were combined into one company of the training group and this was given the number 27 and made part of the 7th Battalion.¹⁷⁶ At first most of the instructors were selected from the best qualified student officers, but later special instructors in addition to these were

provided.¹⁷⁷ All officers on reporting were examined professionally and classified. This gave an excellent idea of the capabilities of the students from a professional standpoint.¹⁷⁵ The post veterinary hospital and all stables in the camp were put at the disposition of this school for instruction purposes. A vacant mess hall made an improvised classroom. At first the basic instruction was given with the medical officers of the training group; this necessitated the veterinary officers receiving a great deal of instruction which, though useful, was not pertinent to an intensive course during war.

The status of the instruction six weeks after the organization of the school can be shown very clearly in the following letter:¹⁷⁶

WAR DEPARTMENT,
OFFICE OF THE SURGEON GENERAL,
Washington, April 4, 1918.

From: David S. White, major, V. C., N. A., War Department, Surgeon General's Office.

To: Acting Director, Veterinary Service, United States Army.

Subject: Report on instruction given veterinary officers, Camp Greenleaf, Ga., March 6 to 30, 1918.

1. Pursuant to a special order, I reported to the commanding officer, Camp Greenleaf, Ga., March 6, 1918.

2. The 27th Company of the 7th Battalion is composed of veterinary officers only, of whom there were 52 at this date. Fifty were second lieutenants in the Veterinary Reserve Corps, two were majors in the National Army.

3. As with all officers under instruction at this camp, veterinary officers are disciplined as privates. They are not allowed to wear rank marks. If, however, they attain, through proper attention to duty, the grade A, B, or C, certain privileges, such as permission to leave camp, wear insignia of rank, etc., on Saturday afternoons and Sundays, are accorded.

4. The company officers and noncommissioned officers are selected from those of the company who show the greatest military aptitude.

5. The daily routine to which veterinary officers are subjected, while strenuous, is excellent for building up the men morally, mentally, and physically. Through lectures, recitations, demonstrations, and quizzes the mind of the officer is kept continuously at work, and through setting-up exercises and drills, both foot and mounted, the body is maintained in condition.

6. Most of the officers gain in weight, color, brightness of eye, and alertness of step, and constipation, anorexia, insomnia, and disinterestedness soon disappear.

7. While each day's routine differs in detail, the officer is kept busy from reveille to taps with something which makes for better discipline and greater military efficiency.

8. Depending on deportment, attention to duty, professional scholarship, military bearing, alertness, etc., the officers are classified as follows: Class A, exceptional; B, above average; C, average; D, below average.

9. The officers of the camp are inspected each week by the commanding officer, and the company receiving the highest score is permitted to fly a special distinguishing flag until it is won by some company at a subsequent inspection. The veterinary company won this flag the second week in camp, which record to date has not been equaled.

10. Until my arrival no provision had been made to give instruction in veterinary matters. While all of the instruction received was of undoubted value, some of it was irrelevant, as it pertained to human beings and not animals.

11. Through the energy of the battalion commander and the courtesy of the officer in charge of instruction at the camp, as many hours as could be spared each day from the prescribed course of lectures, selecting hours at which irrelevant subjects occurred, were allotted for instruction in veterinary matters. Thus from one to three hours daily became available for this work. A classroom was improvised out of a vacant mess hall.

12. The instruction in veterinary matters given consisted in:
 - (a) Lectures, recitations, and quizzes covering S. R. No. 70.
 - (b) Lectures, recitations, and quizzes covering the guide for veterinary officers.
 - (c) Lectures on tables of organization (veterinary).
 - (d) Lectures, recitations and quizzes on blank forms, tags, etc., of the Veterinary Corps.
 - (e) Lectures on supplies and equipment of veterinary units.
13. About 32 hours were devoted to this work.
14. On March 20, 1918, Capt. W. J. Stokes, V. C., N. A., relieved me.
15. Conforming with verbal instructions, I remained with Captain Stokes long enough to assist him in getting started.
16. Returned to my home station, War Department, Surgeon General's Office, supply division, March 30, 1918.
17. With possible betterments in view the following recommendations are made:
 - a. All veterinary officers, whether just joined or of longer service, should be sent to Camp Greenleaf or a similar camp for instruction.
 - b. The curriculum should be arranged so that a certain percentage of the officers (when feasible, selection from the higher grades) may be sent out into the field at stated intervals (say, once every two weeks) and their places filled with officers who have had field service only.
 - c. The location of a veterinary officers' training camp in the medical officers' training camp where they will commingle with officers of other corps of the Medical Department, is, for the present at least, not undesirable. The contact is mutually beneficial, provided, however, that the veterinary curriculum include only relevant courses; i. e., be made as "water-tight" as possible.
 - d. As there is more work than one veterinary instructor can do properly, it is recommended that additional instructors be added as the curriculum becomes intensified and the work develops. Two are needed now.
 - e. The military instruction should be turned over eventually to the veterinary instructors.
 - f. The course in equitation should be made just as military ("drill mounted") as the foot drill. At present it is largely recreative only.
 - g. Veterinary officers should be graded not on military work alone. The following is suggestive in this regard: The officers—professional ability as determined by examination, adaptability to military service, general education, deportment, proficiency in military work, psychological test.

DAVID S. WHITE, *Major, V. C., N. A.*

This method of instruction was followed until June 20, 1918, when, after some correspondence and the receipt of the following letter, the instruction was completely changed:¹⁷⁸

JUNE 8, 1918.

From: The Surgeon General.

To: Commandant, Medical Officers' Training Camp, Camp Greenleaf, Fort Oglethorpe, Ga.

Subject: Veterinary officers in training.

1. It is desired not to request orders for assignment to station of the veterinary officers comprising the class due to graduate June 20 until recommendations have been received from the school regarding promotions and qualifications.

2. As concerns qualifications, it is requested that the men be listed as to their general suitability for the positions enumerated below. Where the main reason for suggesting an officer for a given line of work is his preference in the matter please so state.

3. The positions referred to are:

- (a) Camp veterinarians in divisional cantonments with possibility of becoming division veterinarians.
- (b) Veterinarians at auxiliary remount depots (senior).
- (c) Veterinarians in charge of mobile veterinary units for overseas, *a*, *b*, and *c*, require energetic and progressive men with executive ability and the demand is far ahead of the supply.

- (d) Veterinarians of smaller camps and of Cavalry and other detached organizations.
- (e) Assistants for veterinary hospital units and remount squadrons for overseas.
- (f) Assistant veterinarians.
- (g) Veterinarians for meat inspection service.
- (h) Veterinarians for transport duty.

Under *g* and *h* list only men who have had experience and please state what this experience is.

4. It is requested that this report be expedited for the reason that a new class of 290 is being ordered to report to you for instruction on June 20, 1918.

5. It is also desired that the new class be divided with the view to graduating the most promising half of them July 20, 1918.

C. F. MORSE,
Lieutenant Colonel, M. C.

The new course of instruction was carried out as indicated in schedules which were supplied. These schedules covered the period from July to December, 1918, and were divided into two sets: One for the basic course, the other for the professional course of instruction. Prior to July 20 the professional subjects were given with the basic course, professional lectures being substituted for lectures on the basic schedule, which were of no value to the veterinary officers. Lectures were given on the following subjects:¹⁷⁷ Inspection, purchase, and shipment of animals; disinfection; feeds (grain, roughage, grass); feeding; watering; water; poisonous plants; salting; glanders; influenza; lice, flies, etc.; mange; shoeing; stable management, hygiene; veterinary administrative matters.

On June 20 a class of 200 student officers reported and 100 of the most promising were selected and given an intensive course of instruction.¹⁷⁷ The selected group was designated the "short-term class" and received but one month's instruction. The basic course was given at regularly scheduled hours and the professional course when hours became available during the day, each evening, and Saturday afternoons. The remaining student officers formed a group which was designated as the "long-term class," and received the basic course of instruction during the first month and the professional course during the second month. A new class reported July 20 and the designation of the "long-term class" was changed to the "senior class," the new class being designated the "junior class." From this time on two classes were in attendance, a junior class reporting each month and a senior class graduating or completing the course.

Until the middle of June not one veterinary officer was detailed as instructor, and with the great increase in the number of students and the formation of two classes, the detail of more instructors became imperative. The course of instruction was improved and the scope of the work increased. On September 1 the veterinary officers were formed into a separate battalion and veterinary officers were detailed to serve in the following capacities:¹⁷⁷ 1 battalion commander, 1 battalion adjutant, 4 company captains, 2 quiz masters. The company captains selected the company lieutenants, sergeants, etc. These assignments were for one week only, thus permitting a maximum number of officers to function in these various capacities.

In addition to the regular schedule, the classes received practical instruction in glanders testing (ophthalmic), disposal of carcasses (cremation), and other practical instruction, as time and opportunity permitted.¹⁷⁷ On Saturday

morning the quiz master gave a written examination on the basic subjects covered during the week. The seniors were examined on the professional subjects covered during the week. The grades were entered in the card files, a card being made out for each student at time of arrival. Two sets were kept, one for the basic course, the other for the professional course data, including the qualifications and nature of previous professional work. From these cards were obtained the data for necessary reports.

Student officers having special experience in military or professional matters were called upon to lecture on the subject. The junior students were given a preliminary examination (written) on professional subjects at the completion of the basic course, or as early in the senior month as possible. Men unfit, professionally or otherwise, were recommended for appearance before an efficiency board.¹⁷⁷

SCHOOL OF GAS DEFENSE

The School of Gas Defense was opened November 23, 1917, the gas house being situated at the northern extremity of the camp near the septic tank.¹⁷⁹ During the winter, when possible, instruction was given in the open at the gas field, but when the weather interfered it was given to the enlisted men in the mess halls of the various groups, and to the officers in the "Y" at Camp Greenleaf and later in the Warden McLean auditorium. In the latter part of May, 1918, it was decided to move the gas field to a new location in section B, near the Snodgrass Hill road. (See Chart I.) The gas house was taken down and reerected in the new location, and a convenient administration building, including a lecture hall with a capacity of 200, mask room with racks, and offices, was provided. The new gas field was opened for instruction on June 15, and, with the exception of certain lectures given to the medical officers' training camp classes in the Warden McLean auditorium, all training was given there. Later, benches for the accommodation of 600 men were provided. Instruction was suspended December 7, 1918.¹⁷⁹

During the life of the school, instruction was given to 41,361 enlisted men of the Medical Department and 8,781 officers of the Medical Corps.¹⁷⁹ In addition, instruction was given to approximately 1,300 men and 60 officers of the 11th Cavalry, in August, 1918. In compliance with orders from the Chief of Engineers, on September 16, a full course was given to a class of 1 officer and 32 noncommissioned officers from Camp Forrest, to fit them for instructors in a school to be established in that camp.¹⁷⁹ After that school had been formed, at the conclusion of the training given to the several classes, the men were brought to the gas field at Camp Greenleaf for demonstrations and gas-house experience. The officers and men of the 605th, 210th, 211th, 212th, and 213th Engineer Regiments were in this way passed through gas.

*Equipment.*¹⁷⁹—When the school was opened it was provided with the full equipment for a divisional school as in use at that time, including 496 masks. In a short time equipment used at the Medical Officers' Training Camp at Fort Benjamin Harrison was made available, increasing the number of masks by 504. Additional masks were received from time to time until, when instruction was closed, the supply totaled approximately 6,200.

*Sterilization of masks.*¹⁷⁹—The masks were all sterilized by the gas squad, following the standard method, by compound cresol solution. After each batch had been treated, sample masks were submitted to the laboratory at General Hospital No. 14 for bacteriological examination, with uniformly good reports.

*The gas squad.*¹⁷⁹—On December 2, 1917, three enlisted men were assigned to care for the property then housed in tents at the gas field. The squad later was increased from time to time until it numbered 17. These men cared for the masks, disinfected them, kept them in repair, policed the field, assisted in the demonstrations, etc. Certain of the sergeants and corporals who showed proper capacity acted as drillmasters to the enlisted classes, and without exception the men detailed to this squad showed themselves capable and faithful.

*Meteorological station.*¹⁷⁹—Early in 1918, application was made for the establishment of a field weather observation station at Camp Greenleaf, in connection with the gas school, and when the new gas buildings were constructed, provision was made for this station in the erection of a steel tower for wind instruments. Finally the Signal Service established the Greenleaf station, sending three noncommissioned officers, with the necessary equipment. In addition to the ordinary weather observations, aerological high-level wind observations were taken twice daily by means of hydrogen balloons.

INSTRUCTION

Instruction, as finally evolved, naturally divided itself into two courses, one given to enlisted men and one to officers.¹⁸⁰

Enlisted men.—The course lasted one week and was planned to include 12 hours, 5 hours being devoted to instruction and drill at the gas school, 5 to drill under the mask at their own camps and under their own officers, and 2 to a demonstration at the gas house of gas clouds, tear bombs, and the protective qualities of the mask against lung irritants and tear gases in the gas chamber. The instruction was for the purpose of giving them an understanding of the whole subject and drill in the adjustment of the mask, and included an outline of the gas offense, describing the objects sought for in the use of gas, the physical standards of gas and the atmospheric conditions necessary for a successful gas attack, the types of gases used as to their effects on the individual, and the various ways in which gas was used in actual war. Then the system of protection, including the principles and construction of the mask, as well as the adjustment drill, the action of the vesicants (mustard oil) and means of protection, the construction of gas-proof dugouts and shelters, and the protection of stores, the signs of different kinds of gas attacks and customs of giving and transmitting warnings, as well as the regulations in force at the gas alarm, the methods of clearing trench and adjacent areas of gas after an attack, of repairing damages to property and equipment, and also an outline of first-aid treatment was explained to them. The second part of the instruction, carried on in their own organizations was for the purpose of accustoming the men to work under the mask.

Officers' course.—This course followed the same general lines as that given to the enlisted men, but was naturally much more elaborate. The responsibility of the officer for his men was impressed on them, and the theories and principles involved in both offense and defense were fully explained. In addition the gases used were described in detail and their pathologic effects noted. The principles of treatment were given in as full a manner as the time would allow.

COURSE FOR LINE OF COMMUNICATIONS SERVICE

A special course for line of communications service was given under a letter of instructions from the Surgeon General, November 28, 1917, for text of which see page 78.

SPECIAL INSTRUCTION FOR ENLISTED MEN

Second in importance only to the training of officers was the training of enlisted men of the Medical Department. To this end several miscellaneous schools were conducted at the camp.

SCHOOL FOR ADJUTANTS, REGISTRARS, AND MESS OFFICERS

This school was established pursuant to the following order:¹⁵¹

General Orders, No. 65.

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., June 27, 1918.

1. A school for the training of selected noncommissioned officers as candidates for commission in the Sanitary Corps as adjutants, registrars, and mess officers is hereby established.

2. This school will function directly under these headquarters. The senior instructor, Camp Greenleaf, will provide the necessary instructors and outline and direct the course.

3. The buildings of the former brigade headquarters, South Dyer Hill, with such tentage as may be necessary, are set aside as accommodations for this school.

Personnel pertaining to this school will be quartered and subsisted therein.

Cooks and necessary attendants will not be members of the class under instruction.

4. Each entering class of candidates will not exceed 75, and at the end of two weeks it will be so reduced by vote of the staff of instructors as not to exceed 50. Candidates discharged from one class may be authorized to join another, but not a third.

5. Class of candidates will be limited approximately as follows: For adjutants, 20; for registrars, 8; for mess officers, 20.

6. Candidates will be relieved from duty with any organization to which they may have previously been attached.

7. Training will be both didactic and practical. The didactic instruction will be carried out in the school camp on Dyer Hill.

The practical instruction will be carried out in the officers' kitchens, messes, and School for Cooks of Camp Greenleaf and General Hospital No. 14.

8. As much of the didactic training which would be properly common to the several groups composing this school will be given to these groups together.

The time required for this didactic training will be one month.

9. Candidates under practical training will be quartered and subsisted with the organizations with which they are being trained. For administrative and disciplinary purposes, they will be under the command of commanding officers of such organizations.

The period of practical training will not be less than one month.

10. Course in practical instruction will be so arranged as to include a period covering the latter part of one month and beginning of another, when most of the clerical work is done.

11. Practical instruction as adjutants will be given five groups of four candidates each at the following headquarters offices: Camp Greenleaf, General Hospital No. 14, motor group, animal-drawn group, hospital group.

Practical instruction for registrars will be given the entire group in that subject in the registrar's office of General Hospital No. 14.

Practical instruction for mess officers will be given in the messes of General Hospital No. 14 and the School for Cooks and various public messes of Camp Greenleaf.

12. Candidates under instruction in this school, whether receiving didactic instruction at the Dyer Hill Camp or practical instruction in offices, messes, etc., will not be required to perform any duties not directly pertaining to their special training, other than a reasonable amount of drill and setting-up exercises.

13. Organization commanders will submit to this office, between the 1st and 15th of each month, the names of noncommissioned officers who in their opinion are sufficiently qualified to be acceptable candidates for this course of training.

Designation of those to take this course will be made by this office from among the candidates so recommended.

By order of Colonel Munson:

E. S. SLEDGE, *Major, M. R. C., Adjutant.*

As shown in the above order, the school was first quartered on South Dyer Hill as a separate entity.¹⁸¹ (See Plate I.) In October it was moved to the noncommissioned officers' group and made a part of that command.⁶⁶

A six weeks' course was conducted, followed by from four to six weeks of practical training. After the school became a part of the noncommissioned officers' group, most of the practical training was given in the group by using the students as cadet officers for the companies of prospective noncommissioned officers.⁶⁶

The school started late and therefore the number of graduates was small. The classes graduating about the time of the armistice were given certificates of proficiency instead of commissions.⁶

NONCOMMISSIONED OFFICERS' SCHOOL

The most promising enlisted men were sent to this school for a course intended to fit them for the important work which the noncommissioned officer performs in the Medical Department.⁶ This work was of prime importance, as the call for men so qualified was at all times greater than the supply, and the school was pushed to the utmost throughout. The various headquarters and company officers were utilized for qualifying men for these positions, and men were carefully picked for such duty with that end in view. In the organization of different sanitary units a request was made upon this school by the group concerned, and the number of noncommissioned officers required for such a unit was sent.

The curriculum for the Noncommissioned Officers' School was arranged to cover, as completely as possible, the military duties of noncommissioned officers of the Medical Department, requirements of paper work necessary in all sanitary detachments, and the handling of men; the object being to have on hand and to be able to supply on demand well-trained personnel ready for promotion to corporals and sergeants.¹⁸² It was worked out so that any number of officers might be sent to the school and trained for the specific duties of various units, the training being in part separate and in part conjointly with the men who were to become their enlisted personnel.

The regular curriculum of the school consisted of 24 hours per week of didactic lectures on paper work, selected portions of Army Regulations and of the Manual for the Medical Department, and the solution of practical problems; 7 hours per week on Mason's Handbook of Sanitation and several hours each day of instruction in the school of the soldier, platoon and detachment, litter and shelter tent drill.

SCHOOL FOR COOKS AND BAKERS

This school played an important part in the development of men qualified for positions as cooks and bakers, for which the demand was very great. Men whose trade was cooking or work allied to this, or men who desired to learn the trade, were selected for this course, and an extremely practical scheme of instruction was used wherein the men were given elementary instruction in cooking and were then required to cook in the kitchens of the camp under the direct supervision of the officers of the school. After the school was well organized no sanitary organization left this camp without its full quota of cooks, and a great many men graduating from the school were sent on requisitions elsewhere.⁶

In the early days of the camp, schools for cooks were conducted in practically every section, but they were naturally on a very small scale. Their combined output did not exceed 60 per month.⁹² One special school was conducted in Battalion 15 under the same direction as the school for noncommissioned officers.¹⁸²

Owing to the limited time allotted this course—8 weeks—the instruction was necessarily intensive and the men devoted 12 hours daily to this work, inclusive of 1 to 2 hours of lectures. At all times the men were under the constant supervision of old and competent mess sergeants and cooks. At the outset they were thoroughly drilled in matters pertaining to cooks, police, cleanliness, and sanitation. Gradually, as efficiency manifested itself, they were allowed to assume some of the duties of cooking, until, as the term drew to an end, the embryo cooks were doing all the cooking and the old cooks exercising only an advisory capacity.

By experience it was found that the best results were obtained by the volunteer system. That is, after being in camp a period the recruit had become accustomed to camp life, had gotten considerable drill, had become orientated and in a position to specialize, as it were. Then the duties were made known to the command and volunteers called for, each applicant questioned privately and carefully as to his qualifications, and the duties again explained to him. By so doing a surprisingly large number of highly intelligent, industrious, and capable men could be selected who, by hard and painstaking work, could be made into efficient mess sergeants and cooks. This school furnished numerous cooks to organizations organized in this and other groups of Camp Greenleaf for overseas duty.¹⁸³

The school gradually deteriorated on account of the great demands upon its personnel until it practically ceased to function.¹⁸⁴

In June, 1918, the seriousness of the situation was so manifest as to call for the issuance of the following order:¹⁸⁵

General Orders, No. 59.

HEADQUARTERS CAMP GREENLEAF,
Chickamauga Park, Ga., June 13, 1918.

1. A school for cooks and bakers is hereby established at this camp. It will function directly under these headquarters.

2. The main purpose of this school is to train men in plain Army cookery. Those showing special aptitude will be given a course in cooking for the sick and in the preparation of light diets.

3. The instructor staff of the School for Cooks and Bakers will include an officer in charge and such assistants, both commissioned and enlisted, as may be necessary.

4. Men will not be sent to this school until after they have received fundamental instruction in the duties of the soldier.

They may be taken from any organization in Camp Greenleaf, and during such instruction will be under control of the officer in charge of the School for Cooks and Bakers.

Men who have completed their training as cooks and bakers will be returned to their previous organizations unless ordered away to outside duty.

5. The enlisted men selected for instruction will, as far as possible, be chosen from those who have had some experience in cooking, or who have expressed desire to take up this line of work.

Men who are physically substandard, but not to an extent which would in any way interfere with their efficiency as cooks, may be selected.

6. All men selected for training as cooks and bakers will be given a thorough examination to determine their freedom from communicable disease.

7. Selected men who have qualified in the School for Cooks and Bakers, and who show apparent aptitude for the duties of mess sergeant, will be given a special course of training therefor.

8. The school will be organized on a basis of 300 men under instruction, and with a basic course extending over a period of six weeks. Persons being trained as hospital cooks or mess sergeants will be retained proportionately longer. As far as practicable, classes will be graduated in the proportion of one of 100 men every two weeks.

9. The course of instruction in the School for Cooks and Bakers will be a full-time course, other than such exercises as are necessary to keep the persons under instruction in good physical condition.

10. Six kitchens and mess halls, 12 barracks and 6 lavatory buildings pertaining thereto, located in the eastern end of the cantonments formerly occupied by the 51st Field Artillery, are hereby set aside as accommodations for the School for Cooks and Bakers.

11. Training will consist of a basic course, which will include the theory and practice of cookery, nutrition, and the handling and preparation of the ration. This basic course will be carried out in the buildings of the School for Cooks and Bakers.

It will be supplemented by practical training of persons under instruction in the various public messes of Camp Greenleaf, the regular cooks of these messes serving as instructors for this purpose.

12. The public messes in which practical training in cookery and mess management is being given will be given constant supervision by instructors of the School for Cooks and Bakers. They will report to the officer in charge of the school any mess which may appear to them to be faulty in any respect, with a view to its correction through these headquarters.

13. Pastry, cake, and other articles of food prepared by the School for Cooks and Bakers as part of its work of instruction may be sold to the post exchanges or messes, and the funds used for the purchase of materials and equipment necessary to such instruction.

14. Requisition will be made for such equipment for both post and field use as may be necessary for the instruction work.

By order of Colonel Munson:

E. S. SLEDGE, *Major, M. R. C., Adjutant.*

This newly constituted school was put under the direction of officers assigned to the Nutrition School.¹⁸⁶

In July, 1918, the school was again reorganized, and from that time on it was very successful, no sanitary organization leaving camp without its full quota of cooks, a great many men graduating from the school being sent on requisition elsewhere.¹⁸⁷

A section of the camp was assigned to this school; and besides the barracks occupied by instructors and students, several model kitchens were established and a large model bakery was built, where 20 student bakers could receive instruction at one time. This bakery was built with funds appropriated by the camp exchange, and its output was sold to organizations of the camp and at the several branches of the camp exchange.¹⁸⁷

Just before the armistice was signed this school consisted of 600 student cooks and bakers, and arrangements were being made for the graduation of 200 every two weeks.¹⁸⁸

The main purpose of the school was to train men in plain army cookery.¹⁸⁹ The instructor staff for the school consisted of an officer in command, an officer in charge, supply and mess officer, one officer in charge of classes and instructors, one officer in charge of students taking the practical work in kitchens, and such noncommissioned officers, who were especially adapted for the work, as were required.

The students were men transferred from the draft after they had received fundamental instruction in the duties of a soldier. They either had previous knowledge of cooking, were adapted to the work, or manifested a desire to be cooks. Also men from other organizations were detailed on detached service to the school. When the course was finished the latter returned to their respective organizations. Each student was given a thorough examination in order to exclude the possibility of any communicable disease.

The basic course consisted of six weeks' training. The first two weeks were given to the study of the Manual for Army Cooks, lectures on personal hygiene, and demonstrations in the school kitchens of one or two articles on that day's bill of fare.

For those who had shown special ability during the two weeks' theoretical training, a course was given covering a period of three weeks to fit them for mess sergeants. During this course the textbooks used were Manual for Army Cooks, Mess Sergeant's Handbook, and Mess Officer's Assistant. Such subjects as food spoilage, mess management, purchasing of food, food values, balanced bills of fare, sanitation, handling the Army ration, food substitutes, use and care of kitchen utensils were gone over thoroughly and an examination was given at the end of the course.

In the theoretical course the demonstrations were given by an experienced cook in the school kitchens. The dish demonstrated was cooked and used at the following meal. Questions were asked during and after the demonstration. At the end of the two weeks' theoretical course an examination was held and each student rated. Those showing adaptability were then started on their practical course in the kitchens. Those making a low rating or found inapt were transferred as not suitable for cooks.

The students for their four weeks practical course were assigned to duty in the kitchens, under the supervision of a qualified mess sergeant and good

cooks, as assistant cooks. Here they themselves were required to do the actual preparing and cooking for a company of men. While serving as assistant cooks they were visited daily by an officer, their work supervised, and they were questioned in regard to the kitchen, the food being cooked, and their progress noted.

When they were found not doing the work according to the Manual for Army Cooks, their attention was called to the fact. At the end of the four weeks' practical work the students were again examined. Those found to have made suitable progress were transferred to units in need of cooks. Those making a low rating were kept in kitchens a longer period, until such time as they demonstrated their ability to make second cooks, when they were transferred.

A pastry kitchen was operated for the training of students in the making of pastry such as is used in an army mess. This was supervised by an experienced baker. As nearly as possible all students at the end of their practical training course were given 10 days' practical work in the pastry kitchen before being transferred to other units.

In brief the whole course of instruction consisted of 2 weeks' theoretical study, 4 weeks' practical work, and 10 days' special pastry cooking.¹⁸⁹

By giving the two weeks of theoretical work in one continuous course it was thought the time with about 80 per cent of the men was entirely lost and wasted.

SCHOOL FOR MOTOR MECHANICS AND DRIVERS

In this school men, preferably experienced by reason of former employment along the lines of motor mechanics and driving, were instructed in the work of caring for and maintaining motor trucks and cars, and in addition those showing an aptitude for this work were given preliminary courses along these lines, as well as lessons in driving.¹⁹⁰ No instruction of novices was attempted, but the instruction was given to men who already knew how to drive cars but who required correction of faults and a more thorough knowledge of the machines they were to use. A certain amount of instruction was given motor drivers from the early days of the camp, but such instruction was not well organized or systematic. The school work was reorganized January 28, 1918, and a regular motor school for field sanitary units was established in the motor group.¹⁹¹ No instruction was given men unfamiliar with this work, but all men showing some knowledge of driving or repair of motor cars, who arrived at camp either from recruit depots or in the draft, were assigned to these units and were then sent to the school.

The school consisted of three departments:¹⁹¹ The truck-driving department, which instructed drivers in operating the type of truck assigned to an organization; the truck-repair department, which instructed company mechanics in replacing parts of trucks; the ambulance-repair department, which instructed ambulance company mechanics in replacing ambulance parts.

The truck-driving department.—This department was under the general supervision of the senior instructor, who taught the drivers of each organization to operate their own trucks.¹⁹¹ Each field hospital company and ambulance company having trucks assigned to it placed in charge of one of its trucks

a driver. This driver was definitely and permanently assigned to that truck. Each truck was numbered by the company transportation officer. Drivers thus assigned reported each drill day at 1 p. m. at the place of assembly of his trucks, for instruction in operating the truck so assigned, and devoted the time to care and operation of his truck. The drivers of each organization, during the period of the motor school, were under the charge of the company transportation officer and the immediate charge of the company truckmaster.

As new members were added to the school from the general camp, each truck driver was given a truck in his company, in this way building up in each company its quota of truck drivers permanently assigned to definite trucks.

The truck-driving instruction was under the general charge of a sergeant, first class; and the immediate charge of the truck drivers for each company was placed with the company truckmaster or transportation sergeant. The transportation officers of companies saw that the details reported promptly. They also endeavored to become acquainted with the transportation of their units and the qualifications of the men detailed for this work.

Ambulance-repair department.—This school was placed under the immediate charge of a corporal. The students were two men from each ambulance company and evacuation ambulance company selected by the company commander. One of the men so selected was the company mechanic. These men were known in the company as the two repair men, and were to be instructed so that they would be able to disassemble an ambulance, locate damage, and replace broken parts from the spare parts equipment of the company.

By arrangement with the Motor Transport Corps, one ambulance was available for the instruction of the class daily. An ambulance having broken parts was selected, and it was the problem of the class to locate the damage and replace the broken parts with serviceable ones. The broken parts were turned in to the motor property officer and new spare parts received, so that at the conclusion of the class the ambulance would have been rendered serviceable. The purpose of the class was to train every man so that he would be able to take out a broken part and put in the new one.

The truck-repair department.—This department was conducted, under the immediate charge of a corporal, in the same manner as was the ambulance-repair unit. Arrangements were made with the Motor Transport Corps and the motor property officer so that a truck needing replacement of broken parts might be used for class instruction. Broken parts were taken out and serviceable ones substituted from the supplies on hand, or from the trucks out of service. When no trucks were available for instruction in the foregoing manner, a truck was disassembled by the class and then put together.

The pupils in this class were one repair man from each ambulance company and two from each field hospital.¹⁹¹ Each ambulance and field hospital company detailed to the school a quota of students necessary to keep 40 trucks and 20 ambulances in daily operation for the necessary camp service, hauling wood, supplies, and food; also road building, sanitation, hospital, and incidental quartermaster work, including a quota of company mechanic students to work with qualified mechanics as understudies. This particular quota of drivers was composed of men who had been taught to handle a vehicle or who

had this ability from practice or vocation. With each student driver was placed an understudy or orderly who accompanied the vehicle on its daily road work to observe the manipulation, operation of mechanical parts, rules of road, methods of getting out of bad and rough places loaded and unloaded, etc. This duty the understudy performed for 14 days, during which period, at intervals of every few days, an instructor took him out to teach him actual manipulation, so that at the end of his understudy period he had proved his aptitude to be advanced to drive on light detail work, now being determined whether or not he was material for a field driver, and a report sent to his company commander. After completing this course of two weeks as understudy and followed by two more weeks of road driving, the student was returned to his company for the regular company work during the morning; in the afternoon small classes made up of drivers were detailed from the units to the motor school for advanced work on overhauling, adjustments, and replacement of parts, with individual staff mechanics and instructors who acted as foremen, and thus the work done on the unserviceable vehicles finally placed them in working order for the service of transportation. The aim was to let the student use only the ordinary equipment to keep his vehicle in condition, such as would be supplied in campaign service, and to thoroughly acquaint him with a method of attack for all possible troubles he might encounter in routine field work. The school was using and maintaining some 72 trucks, 40 ambulances, 3 automobiles, and 7 motor cycles, 80 per cent of which were old and worn, a large portion having seen service on the Mexican border. It maintained a spare parts supply department, which was well stocked with all the necessary equipment, tools, etc.

Special instruction was given in assembling motors for the students.¹⁹ Special demonstrations of the make-up of storage batteries, their care and operation; carburetors, their working parts, adjustments, and uses; methods of ignition, generators, and magnetos; wiring adjustments and systems; in short, the advanced classes dissected and replaced all parts of a motor vehicle, which had to pass the final inspection and test before credit was given for the work done. This work was augmented by lectures under the immediate charge of the school director and his assistants.

During the six weeks in operation, the school had in its entirety 175 students on the roll; 75 of this number were advanced students and the remainder were in the driving classes, with 50 per cent of these drivers ready to pass into the advanced class in the course of a few more days on the road work.¹⁹⁰

In the early summer of 1918 the War Department sent three specialists (Sanitary Corps officers) to operate this school. Through their efforts the work of instruction was coordinated and improved so that a very excellent motor school was conducted. During the entire life of the school all officers assigned to motor units received the same instruction as the enlisted men.¹⁹²

The difficulties of pursuing a systematic course of instruction for recruits received in this camp, in view of the numerous calls upon the personnel and the entire uncertainty as to the length of stay of any body of men, caused the adoption of two schedules of instruction, designated "A" and "B," for the first four weeks training.¹⁹³ Recruits received were put through two weeks' training

under Schedule A and then passed to Schedule B. If they remained longer than four weeks they passed on to special training, either in the regular organization to which assigned or in the motor department. The first two weeks of motor instruction was devoted to the classification of mechanics and drivers in order to determine the knowledge they actually possessed. The second two weeks was devoted to training men who were shown to be good mechanics or drivers in the special requirements for handling the motor transportation furnished the Medical Department. Subsequent time was devoted to raising men by instruction to a higher rating. During the first four weeks this instruction was carried on hand in hand with general instruction in the duties of a soldier.

From this school highly trained mechanics and specialists in every phase of motor equipment were graduated. Large classes of trained chauffeurs and motor-cycle drivers were also graduated.¹⁹²

The students who had completed the course of instruction and were awaiting assignment were utilized to handle the motor transportation of the camp, which was concentrated in the motor group.¹⁹⁰ This part was quite a large one, having, in the fall of 1918, 50 motor cycles, 12 touring cars, 60 ambulances, and 100 trucks.¹⁹²

The success of the school can well be judged by the condition of this transportation when inspected by an inspector of the Motor Transport Corps in October, 1918, who reported that this equipment was in better condition than at any other camp he had visited, and at the time of his inspection less than 4 per cent of the motors were in need of repair.¹⁹²

VETERINARY SCHOOL

Enlisted men of the Veterinary Corps at Camp Greenleaf were organized into Enlisted Company A on May 2, 1918.¹⁹¹ The company had a regular company organization and functioned primarily to train men for the duties of veterinary soldiers. At the same time it took over and operated the stables of the medical officers' training camp, with about 400 horses and mules and 210 sets of horse equipment to care for. Although this was an instruction company, it acted as a service company as regards the animals.

The personnel of the company comprised graduate veterinarians and non-graduates. The nongraduates numbered 422, and were of the following vocations: Horsemen, teamsters, farmers, agricultural students, veterinary students, horseshoers, saddlers, farriers, clerks, stenographers, cooks, pharmacists, miscellaneous. From this group were derived a number of noncommissioned officers of long service in the mounted branches who were of the utmost value in training and instructing recruits.

The course of instruction for enlisted men included the subjects of the school of the soldier, foot drill, discipline, honors and customs of the service, sanitary and Infantry drill, tent pitching, gas drill, first-aid and stable management, and other veterinary subjects. All men received daily three hours of instruction in equitation, including fitting and care of equipment and care of the horse.

The care of the animals and equipment afforded much practical instruction in animal management, hygiene and sanitation, and care of equipment.

Additional instruction was provided for the enlisted men who were graduate veterinarians and who were expected to take examinations for commissions. Special attention was given to Army paper work and the rendition of reports. Mimeograph copies of correspondence forms and the most common and important reports were furnished to each man, as were the common War Department manuals. Lectures were given at least twice a week on Army paper work, and the men were also encouraged and detailed to prepare papers dealing with veterinary subjects, which they read before the company.

Company A was disbanded about December 20, 1918, by the discharge of all enlisted men. This included all the graduates and practically all the nongraduates.

SCHOOL FOR FARRIERS

This was a part of Stable Company No 1, in the animal-drawn group, and was organized in February, 1918.³³ Twenty selected enlisted men took this course, in addition to men who performed this duty in each mounted organization.

On May 13, 1918, this school was discontinued, as a separate entity, all men to be trained as farriers being instructed after that date in the veterinary school and transferred to the veterinary department.³⁵

SCHOOL FOR BLACKSMITHS, HORSESHOERS, AND SADDLERS

This school was established in the animal-drawn group in February, 1918.³³ Men rated in the different organizations as blacksmiths, horseshoers, and saddlers were sent to this school for training. The time allotted to this instruction was variable, depending upon the ability of the men. If a student became proficient in a short time, he was sent back to his organization and his place was taken by another man. Plenty of material for instruction was available, as the students not only received didactic instruction, but were required to shoe all the horses and keep the wheel transportation and horse equipment in proper condition.^{33 35}

SCHOOL FOR DENTAL ASSISTANTS

Enlisted graduate or undergraduate dentists were instructed in this school in the work pertaining to their department, and at the end of a specified course men who were found thoroughly qualified in a professional way were recommended for examination for commission in the Dental Corps.⁶

The course consisted of one month's intensive training in the school of the soldier, including gas instruction. As those men were all dental graduates, it was not deemed necessary to give them any professional training. However, they were given a course in Army paper work, and each day eight different men from this company worked in the dental infirmary, which gave them a working idea of the Army equipment. They were also instructed in the unpacking, setting up, and packing of the field equipment.¹⁹⁵

SCHOOL OF PSYCHOLOGY

In this school enlisted men who had had previous experience in this branch, and those who desired to undertake the work, were taught the use of psychology in the Army and the system of morale work.⁶ The work of this school is described under the head of "School of Military Psychology" (p. 100).

ORTHOPEDIC SCHOOL

At the school for care of feet, one of the orthopedic sections for instruction which was afterwards merged into the School of Military Orthopedics, a number of selected noncommissioned officers were instructed in the fitting of shoes and the care of minor injuries of the foot.⁹²

The capacity for the instruction of numbers of enlisted men in the School of Orthopedics was gradually increased, and in April, 1918, 70 enlisted men from 18 organizations were instructed.¹⁹⁶ This instruction was suspended in May, 1918, on account of the many changes and readjustments in the camp during that month.¹⁹⁷ It was recommended in June, 1918, and efforts were made to give basic instructions in minor foot ailments, shoe fitting, and splint application to 4 per cent of the enlisted men of the different organizations.¹⁹⁸ In July this instruction was given to this percentage of men in the motor group, animal-drawn group, and evacuation base hospital group, numbering 440 men.⁴⁷ More intensive instruction of small groups of enlisted men in massage, brace making, minor foot ailments and shoe fitting was begun.¹⁹⁹ During August the instruction of the 4 per cent of the enlisted strength was continued, and 523 men received instruction. It was quite difficult to get the full attendance on account of the large number of outgoing organizations during the month.²⁰⁰ During September 892 enlisted men received orthopedic instruction.

A number of chiropodists were assigned to the camp and received special instruction in the Orthopedic School and were then assigned to different hospital units and to the development battalion.^{201 202}

In October special instruction in shop and plaster work was given to nine selected enlisted men of Base Hospital No. 157 (orthopedic). General instruction was given to 974 enlisted men during that month.²⁰³

The number of students began to diminish in November, only 510 enlisted men being instructed during that period.^{204 205 206}

This school was formally closed December 24, 1918.²⁰⁷

SCHOOL FOR X-RAY TECHNICIANS

The work of this school is described in the discussion of the School of Military Roentgenology (p. 137 et seq.).

MISCELLANEOUS INSTRUCTION

In addition to the instruction given in the schools briefly described above, special instruction was given to enlisted men in the duties pertaining to the following activities: Laboratory helpers;⁹² animal-drawn units;^{3 19} hospital trains⁹² and evacuation group;⁵⁹ convalescent depot and convalescent camp;¹⁸² mobile operating units;¹⁸² sanitary squads.¹⁸²

When it is remembered that the great majority of enlisted men in the Medical Department must be specialists in one or more lines, the importance of these schools and courses will be recognized, and one of the sources of greatest disappointment to the command was that it was frequently not possible to keep enlisted men at the camp long enough to impart the instruction and training intended.⁶

FORT RILEY, KANS.

(June 1, 1917, to June 30, 1918)

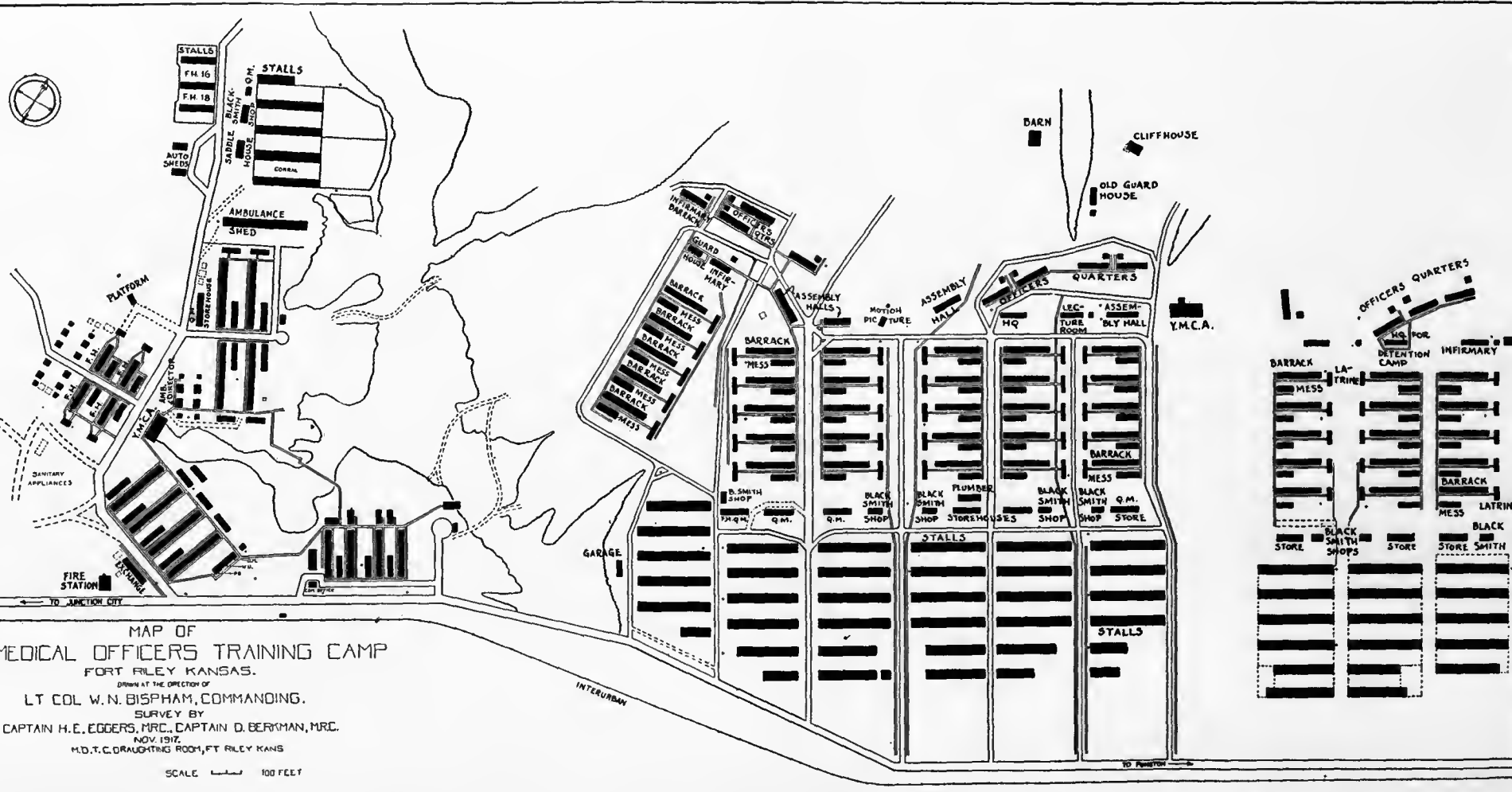
ORGANIZATION

This camp was organized in compliance with a letter from The Adjutant General of the Army to the commanding general, Central Department, dated May 11, 1917, and to the quartermaster general, of the same date.¹ It began to function June 1, 1917.²⁰⁸ On the date of the opening the personnel of the camp consisted of the commandant, nine Regular medical officers, and two enlisted men. The site for housing the camp consisted of a tract of land north-east of the post hospital and north of the main road leading through the reservation. This area extended a short distance up what is known as Magazine Canyon. The terrain rises gradually from the road up to an eminence known as Wireless Hill, upon which was situated the wireless tower. To the east is a ravine through which runs One Mile Creek. Running northeast from the main ravine is a smaller ravine which divides the area described into two parts. That to the south was the section occupied by the medical officers' barracks; that to the north and west was the location of the barracks of the ambulance companies and field hospital companies, with the sheds and stables for their transportation.

This site had been selected a few days prior to the date set for the opening of the camp, and a contract had been let for four barracks, with mess halls and toilets for medical officers, and two barracks, with attached mess halls and toilets for an ambulance company and field hospital company.²⁰⁸ When construction actually began, allotment was also made for barracks, etc., for three more ambulance companies and three more field hospital companies. This last allotment also included stables and sheds for the necessary animals and vehicles, which were completed July 1, 1917.²⁰⁸

Headquarters of the camp was first established in the old Cavalry headquarters at Fort Riley.²⁰⁸ As no barracks were as yet completed, the Artillery guardhouse and the first floor of the Artillery band quarters were also temporarily assigned to the camp for quarters and mess, respectively, for the first student officers reporting. Notice was received from the Surgeon General of the prospective arrival of student officers on June 1, and as accommodations had not been completed, an effort was made to have orders amended so as to have students arrive in time for instruction to begin on June 15. This effort, however, was not successful, and the student officers began to arrive on May 28. On June 1, Student Company No. 1, composed of 34 student officers, was organized.²⁰⁸

The original organization of the student companies provided for the detail of one of the Regular officers on duty at the camp as company commander, but when the number of the companies began to materially increase, company



commanders and other officers were selected from the members of the several companies. Each company averaged approximately 100 students, and was quartered in its own barracks, with mess hall adjacent.²⁰⁹ The companies were combined into battalions and each battalion was commanded by a Regular officer.

The medical officers' training camp was under the commanding officer of Fort Riley for purposes of administration and supply, only the training being in charge of the commandant of the camp, who was responsible directly to the Surgeon General for its accomplishment.²¹⁰

On June 4 regular instruction began, and classes were held in the Artillery guardhouse. Student Company No. 1, on that date, contained 74 student officers.²⁰⁸ On June 7 the camp headquarters was moved to the new cantonment then nearing completion, and on the next day the student officers were moved into the first barrack building to be completed.²⁰⁵ On June 9, 15 noncommissioned officers and 523 enlisted men reported for duty.

On June 12, as enlisted men were arriving in appreciable numbers, a casual detachment was organized to handle all the enlisted men on their arrival.²⁰⁵ In this detachment provisional companies lettered from A onward were formed and placed under command of trained medical officers, and these companies in turn were divided into sections which were placed under the charge of especially selected enlisted men who had been made lance corporals. The lance corporals were promoted or demoted accordingly as they succeeded or failed. Those who made good had the advantage of starting their education in discipline and control of men at the very outset of their military life. From this casual detachment the recruits were assigned to whatever regular units were to be formed, such as field hospitals, ambulance companies, and evacuation hospitals.

It was realized that a camp exchange was of very great value, not only in providing articles needed by the personnel of the camp, but also to retain the profits of such sales in the camp to be distributed among the units to be formed. An officer was detailed as exchange officer, and when the camp was ready for occupancy an exchange was established in the headquarters building. It opened for business on June 19, 1917.²¹¹ The business of the exchange increased enormously and finally a large building to house it was constructed from the funds of the exchange. In addition to the usual articles kept for sale in such stores, clothing and equipment for officers were handled, thus decreasing materially the necessary expenditures for these items made by officers entering the service. Each unit formed in the camp became a stockholder in the exchange, and on its departure from camp a settlement was always made. Frequently from this source alone a company would leave camp with a company fund of over \$1,000.

A number of officers and enlisted men of the National Guard were ordered to the camp for instruction, and they began to arrive June 20.²⁰⁸ The officers were combined into a company separate from the Reserve officers, and the enlisted men formed a detachment, which was placed under the command of one of the National Guard officers.

The first ambulance company (No. 18) and field hospital company (No. 18) to be formed completed their organization on June 24. A few days thereafter,

Ambulance Company No. 17 and Field Hospital Company No. 17 were organized.²⁰³ Officers for all of these units and for most of those subsequently formed were detailed for this duty from the student companies. If for any reason an officer did not perform satisfactory service on this duty, he was relieved and another detailed in his place.

At the end of June, 1917, 179 student officers had reported for instruction, and 60 noncommissioned officers and 1,626 enlisted men had reported for duty and instruction.²⁰⁸ The teaching staff of Regular medical officers at this time was 12, including the commandant.

On July 8 Ambulance Company No. 20 and Field Hospital Company No. 20 were organized, followed by the organization, on July 12, of Ambulance Company No. 19 and Field Hospital Company No. 19.²⁰⁸ During the month of July a special athletic department for the camp was started.²⁰⁸ An officer who had had a great deal of experience along this line was detailed as director. This department not only arranged athletic events and entertainments, but also superintended the physical instruction of the officers and enlisted men. An open-air theater accommodating from 2,000 to 3,000 men was designed and built. In this theater nightly entertainments of some sort were provided. An athletic field was laid out, and the outdoor physical instruction was so arranged that every man of the command got proper physical instruction daily. During this month 58 additional officers and 365 recruits reported for instruction.

In preparation for the early transfer of regimental detachments to the divisions to be formed, these detachments were organized in the provisional companies of the casual detachment and received very thorough instruction in regimental work.²⁰⁸

A Young Men's Christian Association building for the camp was opened formally on August 4. This building was in the center of the camp and its many aids for the welfare of the men were taken advantage of by a large majority of the camp personnel.²⁰⁸

On August 11 a Regular medical officer arrived in camp and gave approximately one week's course of lectures on military surgery, and the first review held by the camp was given him on August 16.²⁰⁸ On August 12, 12 assistant instructors were selected from the student officers who had been under training in the camp.²⁰⁸ On August 13 and 15 Provisional Ambulance Company No. 1 and Provisional Field Hospital Company No. 1 were organized.²⁰⁸ All of the companies for which authorization had been received had been formed, and these new units were organized to form a training unit for future companies, which might be ordered. These companies were kept filled to their capacity, and as soon as a new unit was started the major portion of the personnel was assigned from one of the provisional companies, and the provisional company in turn was filled by recruits from the casual detachment. On August 14 the first enlisted men were selected for service overseas.²⁰⁸ The detachment of officers and enlisted men to form the nucleus of the regimental services and sanitary trains of the 91st Division (Camp Lewis), 87th Division (Camp Pike), 88th Division (Camp Dodge), 90th Division (Camp Travis), and 89th Division (Camp Funston) left camp August 25.²⁰⁸ The number of officers sent to each

camp was 40. The last part of August saw the gradual withdrawal of a number of Regular officers from the camp to duty elsewhere and the detail in their places of reserve officers from the student companies which had just completed their three months' course of instruction. From that time on, all new instructors and assistant instructors were taken from the reserve officers on duty in the camp.

During the month of August, the first three companies of student officers completed their course of instruction as far as it was possible for them to go, and seven new companies were formed having at the end of the month, 1,028 officers under instruction. During the month 1,006 additional officers and 470 recruits reported to the camp for instruction.

A press bureau was established at the camp in August in order that helpful and proper advertising might be given this training.²⁰⁸

A complete system of trenches built according to the plans of those used on the Western Front, was started at this time, and their construction was continued by the labor of enlisted men who were afterwards to be detailed to regimental detachments. This method of construction was used so that there would be at least a few men in each detachment who were familiar with trench construction.²⁰⁸

On September 8 the officers and men of the National Guard who had been under instruction at the camp for two months were ordered back to their commands.²⁰⁸ During September 102 officers and 1,392 recruits reported to the camp for instruction, and Companies No. 11, No. 12, and No. 13 were organized.

Quite a number of dental officers had recently arrived in camp, and as they were all new men a course in Medical Department paper work was started and these officers were given instruction in all papers which concerned the Dental Corps.²⁰⁸

The first evacuation hospital which was formed in this country during the war, Evacuation Hospital No. 1, was organized October 10.²⁰⁸ The entire personnel, both officers and men, were selected from those on duty at the camp and the unit received very careful training along military lines. During October only 14 officers and no enlisted men reported for instruction. On the other hand 332 officers were ordered to other stations for duty.²⁰⁸

In spite of repeated requests no allotment was made to prepare the barracks and other buildings for winter occupancy.²¹² The buildings as originally constructed were built with a single sheathing of partially cured lumber and the walls of the barracks had shrunk to such an extent that many cracks were visible, and it was realized that during the winter they would be uninhabitable. As the camp was left to its own resources, different expedients were made use of to make the buildings comfortable. Permission was obtained to haul from Camp Funston scrap lumber left from the construction of that cantonment. Altogether 100 truck loads of this material were obtained. All the carpenters found among the enlisted men were organized into a separate detachment and put to work lining the inside of the buildings with this lumber. The walls were first covered with newspaper and some tar paper purchased locally from

company funds, and then wainscoted to the height of the windows. By this method the wind was kept out and the barracks were made very comfortable and tight for winter without the expenditure of Government funds. By the end of November a large number of the barracks had been completed in this fashion.

In November the first hospital trains were organized.²¹² As their training was of a rather special character, a building was remodeled in such a way as to simulate the interior of a hospital car. A number of these units were formed in this camp and sent overseas.

Most of the work of training heretofore had been confined to sanitary trains and regimental sanitary detachments, but during this month orders were received to organize a number of evacuation hospitals. In these units all of the enlisted personnel was furnished by the camp, but the officers were detailed to them by the War Department.²¹²

During the month of November, 16 officers and 85 recruits reported to the camp for instruction.²¹² Seventy-nine officers were ordered to other stations for duty, including eight officers ordered to Deming, N. Mex., for duty, five to the 34th Division and nine officers ordered to Washington University, St. Louis, for a course of instruction in head surgery. Four hundred and eighty-six enlisted men were ordered to duty at other stations.

The gas house, which provided for gas instruction, was completed on November 16.²¹² Evacuation Hospital No. 7 was organized during this month, but no additional training companies were formed.²¹²

During the life of the camp (June 1, 1917, to February 4, 1919) the following units were organized:²¹³ Evacuation Hospitals 1, 7, 9, 10, 11, 12, 15, 16, 17, 19, 20, 21; Base Hospitals 70, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90.

The cantonment previously occupied by the 13th and 20th Cavalry Regiments and the gun sheds and artillery stables in the post of Fort Riley were turned over to the camp during the month of December. These additional buildings were to be used to accommodate the expected expansion of the camp.²¹⁴ An allotment of \$80,000 was made to remodel and to fit the gun sheds and artillery stables for barracks and the temporary buildings in the cantonment for winter occupancy.²¹⁴ When the material purchased for this work was received, a construction company of 100 men was formed from the enlisted men in the camp. This company furnished all the labor, both skilled and otherwise, and the work was brought to a rapid and successful conclusion.²¹⁴ The remodeling of the permanent buildings consisted of building large stairways to the second floors of the gun sheds, of flooring the stalls in the stables, of installing baths and toilets, and of arranging one gun shed as a mess hall and kitchen.²¹⁴

During the month of December, 387 Medical Department officers and 885 enlisted men reported to the camp for instruction.²¹⁴ Twenty-one officers and 79 enlisted men were ordered to other stations for duty. The department of current literature and Student Companies Nos. 15, 16, and 17, were organized during the month. Orders were received for the establishment, in connection with the basic course, of the schools of military Roentgenology and military orthopedics. The unassigned officers in the camp who had not been recommended for any particular line of duty were placed under observation and

carefully examined with a view of eliminating the unfit and assigning the qualified to duties for which they were best fitted.²¹⁴

During January, 1918, 274 officers reported to the camp for instruction. No enlisted men were received during this month. Orders were received during this month for sending large numbers of enlisted men to various base hospitals and other stations for duty in the United States and for overseas service. It therefore became difficult to fill the many requisitions received, and the training of both enlisted men and officers was somewhat hampered through this shortage.²¹⁵

The weather during the month of February being very mild a good deal of work was done in the sanitary laboratory, and all of the different types of incinerators were tried out under strictly scientific conditions.²¹⁶ It was determined by experiments that the amount of wood necessary as fuel in wood incinerators was excessive. As a result of these experiments a new incinerator was invented and used successfully throughout the remainder of the life of the camp. One hundred and seven officers reported for instruction during this month, but no enlisted men arrived. One hundred and fifteen officers were ordered to other stations for duty, eight were discharged from the service and ordered to their homes. Four hundred and sixty-four enlisted men were ordered to other stations for duty. Weather conditions made possible the more satisfactory drilling of companies and physical instruction of the command. The work in the map-drawing department was also made more satisfactory during this month. The personnel of field hospitals was cut down to such an extent in order to furnish details for base hospitals throughout the country that lectures and recitations only could be given these organizations.

On March 2 the first men to be received from the draft reported to the camp for induction into the service.²¹⁷ Prior to this all increments of enlisted men were either from recruit depots or transfers from other camps. Two hundred and sixty-three had reported to the camp on this date for voluntary enlistment.²¹⁷ About 4,000 men were received during the following week, but the rejections totaled 8 per cent of the whole.²¹⁷

During the month of March, 14th, 15th, 16th, 17th, and 18th Companies completed their courses.²¹⁷ Unfortunately, on account of the exigencies of the service, the number of men remaining to the end in the basic courses of these companies was a comparatively small percentage of those who started. Two hundred and one student officers reported to the camp for instruction and 377 were ordered to duty elsewhere, 22 officers were honorably discharged from the service during this month and 2 officers resigned.

A large replacement detachment, consisting of 52 medical officers and 700 enlisted men for overseas service, was sent out April 1.²¹⁸ Four hundred and twenty student officers reported for instruction during the month and 130 were ordered to duty at other stations. Officers and enlisted men had previously been sent to camps and stations all over the country, but apart from a few individual officers and a small number of enlisted men none of the personnel had heretofore gone directly overseas. Later, continuous drafts for overseas service were made on this camp.

The second increment from the draft received at the camp began to arrive May 24.²¹⁹ It consisted of 3,000 men. In May the thirty-third, and last, student company to be formed in the first camp was organized. One hundred and five officers and 604 enlisted men were ordered to other stations for duty, and on June 1 a replacement draft for overseas service, consisting of 200 officers and 1,040 enlisted men was ordered out.

The third increment began to arrive June 25 and this also consisted of 3,000 men.²²⁰ *

The meeting of the American Medical Association in Chicago in June was attended by a large number of officers from the camp, and an exhibit of models of field sanitary appliances made in the sanitary laboratory received the gold medal. At the special request of the association, the band from the camp was sent to Chicago and gave concerts the week in which the sessions were held. This band was the first 50-piece band to be organized in the Army, and as it was not officially authorized, the instruments had to be bought from private funds. These funds were provided by the publication of a camp yearbook.²¹¹

The general training of officers began to diminish from the 1st of June as the officers in training were gradually ordered away and very few officers reported at the camp for instruction.²²⁰ This was due to the decision to stop all general training at the camp after July 1.²²⁰ After that date the camp was used as a replacement and training camp for regimental detachments and sanitary trains.

As plans for training Medical Department personnel progressed, it appeared advisable, early in 1918, to consolidate the efforts of the Medical Department along these lines by combining the Medical Officers' Training Camp at Fort Riley with that in operation at Fort Oglethorpe, Ga., and by the expansion of the training camp at Fort Oglethorpe to conduct instruction of all Medical Department personnel there. An endeavor was made to secure the authority of the War Department for this movement, but The Adjutant General of the Army disapproved of such action, and ordered a continuance of the training camp at Fort Riley.²²¹ It was apparently considered that the maintenance of a training camp for the Medical Department was required in the central west to curtail the amount of travel of personnel called into service from a territory nearer that area. The Surgeon General, however, was able to secure authority for the transfer of a large number of medical officers, both Regular and reserve, and 300 enlisted men from Fort Riley to Camp Greenleaf, and thus a partial merger was effected. These officers and men left for Camp Greenleaf early in July, and what might be called the first Medical Officers' Training Camp at Fort Riley closed July 1, 1918.²²⁰

From June 1, 1917, to June 1, 1918, 2,094 officers and 9,228 enlisted men arrived at this camp for training, after which they were assigned to other stations.²²² On May 31, 1918, there remained in camp, under training, 986 officers and 6,809 enlisted men. During June approximately 450 medical officers were ordered out to various stations in the United States and to service overseas, in addition to those composing the organized units.²²⁰

GENERAL INSTRUCTION FOR OFFICERS

Instruction was followed according to the outline prepared in the office of the Surgeon General and later published as Special Regulations 49a, 1917. Schedules were made covering the hours specified, and instruction was begun on June 4, 1917.²²³ The method pursued was to detail instructors to certain specific subjects and to place all instruction in these subjects under their charge. At first only Regular officers were detailed as instructors, but as the camp increased in size and the reserve officers became more conversant with the work, some of the best qualified among these were detailed to the instruction force. Each training company, consisting approximately of 100 officers, had a separate schedule. It was necessary for each company to have a separate schedule because officers reported for duty irregularly, a few at a time, and the number 100 was taken as a basis for the formation of companies, as each barrack held approximately that number. These schedules were identical in subjects and number of hours for each subject, but naturally varied as to the time of any specified instruction. They were carefully made out, so that the time for the instruction of the several companies in any one subject did not conflict. This method had the redeeming feature, that the classes to be handled by one instructor were of convenient size, and permitted a more personal contact with the student officer. In giving this instruction, lectures were eliminated as much as possible and were only used to outline some important military or professional principle. Practical demonstrations, recitations, and the actual performance of the duties taught, comprised the major part of this instruction, and the final results showed that this method was successful.

Physical and military drills were conducted by companies under carefully selected instructors, and always under the supervision of a well-qualified Regular officer.²²³ Shortly after each company was organized, members of this company were detailed by roster for one week's duty with either an ambulance company or a field hospital company, and during the drill period they were on duty with these companies, and also received other instruction when practicable, though they were not excused from the instruction outlined in the regular course. By this means the suitability of officers for this type of work was readily determined.

Army Regulations, Manual for the Medical Department, and Manual for Courts-Martial, were taught the student not with the idea that he would thoroughly digest these works and be able to make decisions without reference to the text, but to thoroughly ground him in the principles underlying these regulations.²²³ They were also taught the use of these manuals, so that on occasion they would know where to look for the correct information. The instruction in the examination of recruits was entirely practical. Each officer was given personal instruction by the instructor, and was then given recruits to examine. Their errors were shown them, and every effort was made to perfect them in this work before they left camp. In handling paper work every officer was required to complete an entire set of the regular Medical Department forms from data furnished him, and the principles underlying the use of these papers were thoroughly explained to him. When field equipment of any kind was studied, the student officer was required to handle it himself. This method gave him an actual personal knowledge of the equipment.

As the student officers were direct from civil life, the field equipment of the Medical Department was naturally strange to them, differing in so many ways from that which they were accustomed to use in their practice. All of this equipment was carefully explained to them, and they were given the reasons for its use and also the reasons why the equipment they had used in civil life could not be used in the field.²²³

As many of these officers were being trained for front-line work, their instruction in map reading and sketching, while elementary was extremely thorough, so that they could readily read a map and on occasion send back an accurate description of where their dressing station or other unit was located.²²³

In the beginning no horses were furnished the camp, so equitation, though scheduled, could not be given.²²³ This period, therefore, was used by giving the class a short march of from 3 to 5 miles. No attempt at grading these marches was made at first, but later a new class was taken a very short distance at the beginning, to be increased as the officers became more hardened to the work. This was found to be an excellent method of rounding out the day and most officers felt much better for it. The equitation instruction itself was not conducted with the idea that these officers would be made finished horsemen, but their instruction was limited to the most elementary principles, teaching primarily the correct seat and how to control and handle a horse.

It was impossible to give a complete course in mess management in such a limited time, but a certain number of officers were detailed as assistants to the mess officer for one week at a time, and these officers were made familiar with the most approved methods used in this work.²²³

During the periods of the basic course allotted to hygiene and sanitation, the classes were given practical demonstrations as to how sanitary inspections should be made, and in the laboratory of field sanitary appliances they were not only shown the actual working of approved methods but were required to make drawings of appliances which they were most likely to find useful to them in the future.²²³

The salient aspects from a medical officer's standpoint of the following professional subjects as developed during the war were taught by instructors thoroughly familiar with the subjects: Military surgery, cardiovascular and pulmonary diseases, orthopedics, war psychoses, and neuroses.²²³

Instruction in sanitary tactics was confined to the principles of this science, and after a thorough grounding in them, these principles were put into effect, first, on the map in map maneuvers and later in actual maneuvers held on the reservation.²²³ Every effort was made to have the latter as realistic as possible, using the actual number of sanitary troops with their equipment that the strength of the command engaged called for. Details of men to act as wounded were made and these men were distributed about the battle field, properly tagged. The actual dressing of these men and their removal from the field was performed by the student officers and troops furnished for the purpose. The commands used in these maneuvers were never larger than a regiment. Complete maneuvers of a division in both offense and defense, with the proper allotment of sanitary troops, were held for the first four companies, but later companies remained so short a time that their instruction could not be brought to this point.

Only the first three companies as a whole completed the three months' course as outlined.²²³ Later companies gradually disintegrated on account of the pressing need of medical officers. As officers were required to fill details to divisions, etc., the average men in the companies were sent out first, leaving the best and the poorest. The best men were kept to be trained more thoroughly for important details and the poorest to give them the benefit of as much instruction as possible so as to raise their general efficiency.

As the camp progressed it was found that the original plan of instruction did not include certain important parts of the work, and special departments were instituted to cover these deficiencies.²²³ The first of these was a department for the inspection of communicable diseases, which afterwards became the School of Epidemiology. This was started October 13, 1917.²⁰⁸ Officers specially qualified for this work were given instruction in this department, consisting of lectures and detailed instruction combined with the actual inspection and handling of communicable diseases at this camp and at Camp Funston.²²³ The course was indefinite in length, and as the demand for officers qualified to do this work arose, the best instructed men were detailed.

The physical instruction of the officers at first was uniform, but on account of the decided range in age of these men, two classes for physical instruction were started, one division for all officers under 40 years of age, and the other for all those over 40.²²³ The former were given the regular course, but the latter received carefully graded instruction, so that no strain would be put upon an older and potentially weaker heart. This was done with the knowledge that officers of the second age group who have lived sedentary lives are easily injured if they are permitted to perform exercises of a more or less strenuous character, though later on, after a thorough and gradual development, they would possibly stand the same amount of strain as the younger men. This special physical instruction was under the direct supervision of officers specially qualified for this work. The older officers were watched closely, and when, in the judgment of the instructor, an officer was found who could not stand the hardships of any kind of Army work he was reported to the regular physical examining board of the camp, and if they agreed that any service would probably prove dangerous to him he was recommended for discharge. Some difficulty was experienced, at first, in getting the personal cooperation of these older officers, for naturally it was trying for them to start the course of exercise after years of a sedentary occupation. But after the results were seen the officers themselves were anxious to take advantage of the instruction. This class averaged 100 daily, and by steady training became able to do work which they were physically unable to accomplish a short time before. The exercises given were of a graded nature, beginning with gentle resistance exercises. These were gradually increased in degree, and breathing and boxing exercises were added as the class progressed.

Instruction in gas defense was carried out at first theoretically with naturally little success, but on November 16, 1917, a gas house was completed, after which the course was conducted in a very thorough manner.²²³ This course was the same as that outlined for the divisional camps (q. v.).

As medical officers at a training camp were decidedly separated from professional work it was thought that they should be kept abreast of the progress in medical science, particularly that of the military service. To accomplish this a department of current literature was organized and an editorial board selected from the best qualified officers in the camp.²²³ This board abstracted the current literature and once a week the entire student body was assembled and given the results of the labors of the board. The material was afterwards mimeographed for general distribution. It was not considered practical to include all branches at one session, so one week was devoted to surgery, another to internal medicine, etc.

SYLLABUS OF GENERAL INSTRUCTION

To carry out the instruction outlined above in a uniform manner, a syllabus covering all the important subjects was prepared.²²³ It might be considered that such a method would cause criticism, in that it limited the initiative of the individual instructor. This criticism in times of peace would be justified, but in the rapid training of officers for war service, uniformity of instruction was very necessary.

This syllabus is given in detail:²²⁴

DRILL INSTRUCTION

Drill Regulations and Service Manual for Sanitary Troops.

General instruction in forming company.

General principles, articles 1-24, inclusive.

Instruction in company formation for retreat.

School of the soldier, articles 27-38, inclusive, and 40-54, inclusive.

Instruction in formation for Saturday a. m. inspection, articles 220-221, inclusive.

School of the detachment:

Articles 55-73, inclusive.

Articles 74-79, inclusive.

Articles 80-89, inclusive.

Special attention to column of platoons and line of platoons:

Articles 90-92, inclusive.

Article 25, arm signals.

School of the battalion.

Mass formations.

Parades and reviews.

Litter and ambulance—litter drill.

General instructions, articles 93-97, inclusive:

(a) Manual for closed litter.

(b) Manual for open litter.

(c) Manual for ambulance litter drill.

(d) Manual for marching with litter.

(a), (b), and (c) at ambulance sheds; (d) on drill grounds.

Remarks.—Progressive instruction given as outlined.

Litter and ambulance drill began for each student company when they had progressed to article 74.

Instruction and exercise in giving commands.

Grading drill, giving every student an opportunity to exercise command.

On days when outdoor instruction was inadvisable, indoor quizzes and blackboard work were substituted.

No arbitrary number of hours were scheduled for each lesson, as each company progressed as rapidly as they became proficient and all completed the course in the prescribed number of hours.

SYNOPSIS OF COURSE ON PHYSICAL TRAINING

The following abstract on physical training gives commands only. Methods of execution were learned from Koehler's Manual of Physical Training, from attending physical drill, or from the instructor in physical drills.¹¹⁶

FORMATIONS

FALL IN; count FOURS. Take physical exercise interval; MARCH. Company, HALT. Company assemble on No. 1 (or 4); MARCH.

STARTING POSITIONS

Arms forward, RAISE. Arms, DOWN. Arms upward, RAISE. Arms sideward RAISE. Arms across back, PLACE. Arms to thrust, RAISE. Arms across chest, PLACE. Hands in rear of head, PLACE. Hands on shoulders, PLACE. Arms upward, thumbs locked, RAISE. Side straddle position, PLACE. Leaning rest position, PLACE. Squatting, hands on ground position, PLACE. Side straddle, arms upward, thumbs locked position, PLACE.

EXERCISES

The preparatory command and command of execution for all exercises not starting positions, are "Ready, EXERCISE." Exercises should alternate between arms, trunk, and legs to avoid monotony and fatigue. "Company, HALT." Discontinue any exercise. "Company, ATTENTION" brings from any position to attention.

First series

Eleven sets of three each.

1. Finger: Forward, backward, close, open, circular.
2. Right ankle: Hands on hips, PLACE. Down, up, in, out, circular.
3. Wrist: Forward, back, up, down, circular.
4. Left ankle: Hands on hips, PLACE. Down, up, in, out, circular.
5. Arms: Arms sideward, RAISE. Forward, backward, up, down, circular.
6. Right leg: Hands on hips, PLACE. Forward, backward, out, in, circular.
7. Shoulders: Arms to thrust, RAISE. Forward, backward, upward, downward, circular.
8. Left leg: Hands on hips, PLACE. Forward, backward, out, in, circular.
9. Neck: Hands on hips, PLACE. Forward, backward, right, left, circular. (Eyes closed in neck exercises.)
10. Trunk: Hands on hips, PLACE. Forward, backward, right, left, circular.
11. Arms: Forward, backward, upward, sideward, downward, sideward, circular.

Second series

1. Side straddle exercises: Ready, EXERCISE (two counts).
2. Side straddle triplet: Side straddle position, arms upward, thumbs locked (or fingers laced), PLACE. Downward, upward, right, left, circular.
3. Side straddle full bend: Side straddle position, arms upward, fingers laced, PLACE. Downward, upward, touch knuckles to ground, knees extended.

Third series

1. Leaning rest leg exercises: Leaning rest position, PLACE (two counts). Flex, right knee (two counts). Flex, left knee (two counts). Right leg position, PLACE. Alternate flexing knees (two counts). Company, ATTENTION.
2. Leaning rest arm exercise: Leaning rest position, PLACE. Flex arms (two counts). Company, ATTENTION.
3. Leaning rest leg sideward exercise: Right (two counts), left (two counts), both (two counts).

Fourth series

1. Squatting hopping circle-arm exercise: Squatting position, PLACE. Arms sideward, RAISE. Hop and circle arms (one count).

2. Squatting hands on ground leg exercise: Squatting hands on ground position, PLACE. Right, left, both. Company, ATTENTION.

3. Squatting—leaning rest exercise: Squatting hands on ground position, PLACE. Extend and flex both legs (two counts).

Always concluded with lung exercise: Inhale (raise arms upward slowly, inhaling through nose); exhale (return arms rapidly, mouth open to let air escape rapidly).

After any strenuous exercise give a few lung exercises.

Other series and groups of exercises were prescribed as the proficiency of the class permitted.

THE FIELD HOSPITAL

A. History.

1. Earliest knowledge.
2. Uses in previous wars.
3. Early uses in wars—this country.
4. Progress—in the transportation and personnel as well as material up to the present day.

B. Authorization and organization.

1. Paragraphs 157 to 167, M. M. D., pertaining to animal-drawn vehicles—later motorized companies.
2. Personnel (officers, Medical Department and Quartermaster Department. Enlisted men, Medical Department and Quartermaster Department).
3. Equipment—
 - Medical Department.
 - Quartermaster Department.
 - Ordnance Department.
4. Transportation—
 - Medical Department.
 - Quartermaster Department.
 - Civilian.
5. Instruction: Brief outline, including discipline—officers and enlisted men.

C. Administration.

1. Assignment of personnel—exact manner of acquiring full quota of officers and enlisted men, commanding officer, adjutant, etc.
2. Paper work.
 - a. Reports—daily, weekly, monthly, quarterly, emergency, semiannual, and annual.
 - b. Requisitions—form number. Quadruplicate.
 - I. Authority for same.
 - II. Disposition of same.
 - c. Property (complete).
 - I. Acquisition and replenishing of field supplies.
 - II. Accounting for same.
 - III. Responsibility and accountability.
 - IV. Inspection and condemnation—public animals and other property.
 - V. Survey of: (a) Purpose. (b) Relief from responsibility and accountability. (c) "Dropping" of property. (d) Durable property.
 - d. Company fund—hospital fund.
 - I. Mess officers and supervision of mess.
 - II. Mess sergeant and purchase of supplies.
 - III. Sources of revenue.
 - IV. Expenditure authorized and monthly statement of fund.
 - V. Manner of returning mess: (a) Keeping on daily slip absolute cost per meal for each article used. (b) Auditing purchases daily from all sources and initialing of vouchers by mess sergeant and mess officer. (c) Durable property.

D. Transportation.

1. Care of animals, wagons, harness, motors, etc.
2. Equitation, hippology, study of motors (internal parts, fuel—consumption of).
3. Motors, etc.

E. Duties of field hospital.—Duties acting in conjunction with ambulance companies—with evacuation hospitals—with evacuation ambulance companies. Their relations to regimental officers.*F. Duties and responsibilities of the commanding officer, field hospital company.*

1. Care of his personnel and transportation.
2. Care of troops on march—each night.
3. Selection of proper site for pitching field hospital company.
 1. Shelter—artillery fire.
 2. Marking with guidon to show approach.
 3. Proximity to roads and water—drinking, cooking, watering of animals.
4. Efficiency for prompt treatment and evacuation.
5. Records.
6. Orders.
7. Contact with directors.
8. Dead—identified—recorded and evacuated.
9. Detail of personnel so that a few men will always be available for immediate special duty.
10. Proper pitching of field hospital in one-half hour and ready to take care of patients.
11. Having all equipment on hand originally and keeping of such as is lost, broken, or used replaced.

G. Practical demonstration of field hospital (one afternoon).

ARMY REGULATIONS

CHAPTER I (FIRST 6 DAYS)

First lecture: Military discipline, general organization of the Army:

- a. Company, battalion, regiment, brigade, division.
- b. Staff departments, General Staff Corps, Territorial departments, etc.
- c. Honors, courtesies, and ceremonies.

Second lecture: Fifteen-minute quiz on last lecture.

- a. Leaves of absence.
- b. Officers traveling on duty.
- c. Retirement of officers.
- d. Resignation of officers.
- e. Deceased officers. New insurance act.

Third lecture: Fifteen-minute quiz on last lecture.

- a. Detached soldiers.
- b. Service records.
- c. Furloughs.

NOTE.—Service record and furlough blanks were given the class to be drawn and filled in as directed by instructor.

Fourth lecture: Fifteen-minute quiz on previous lecture. Papers of the day before turned in.

- a. Transfer of enlisted men to the Medical Department.
- b. Deserters.
- c. Discharges.
- d. Final statements.

NOTE.—Five discharge blanks and final statements were properly filled out by the class as directed by the instructor.

Fifth lecture: Fifteen-minute quiz on previous lecture. Papers of the day before turned in.

- a. Certificate of disability.
- b. Proceedings of disability boards.

NOTE.—Five certificates of disability blanks were properly filled out by the class as directed by the instructor.

Sixth lecture: Written quiz on previous lectures. Papers of the day before turned in.

CHAPTER II

Seventh lecture: Fifteen-minute review on common errors noted in written quiz.

- a.* Deceased soldiers. Letter made out notifying commanding officer of death of man in the detachment. Explanation of the new insurance act.
- b.* Extra and special duty.
- c.* Soldiers' Home.
- d.* Troops, batteries and companies (pars. 275, 276, 277, 281).

Eighth lecture: Fifteen-minute quiz.

- a.* Interior economy of companies.
- b.* Messing and cooking.
- c.* Company and mess funds (par. 327).

Ninth lecture: Fifteen-minute quiz.

- a.* Government Hospital for the Insane.
- b.* Public property and accountability.

Tenth lecture: Fifteen-minute quiz.

- a.* Surveys.
- b.* Inventory and inspection reports. Inspector General's Department.
- c.* Destruction of property.

NOTE.—Five survey blanks and inventory and inspection reports were properly filled in by students as directed by instructor.

Eleventh lecture: Fifteen-minute quiz. Papers of the day before taken up.

- a.* Adjutant General's Department.
- b.* Military correspondence. A letter with two indorsements was written.
- c.* Orders.

Twelfth lecture: Written quiz on previous five lectures.

CHAPTER III

Thirteenth lecture: Review of common errors noted on written quiz.

- a.* Muster roll.
- b.* Pay roll.

NOTE.—Five copies of each were turned over to the company to be completed by students.

Fourteenth lecture: Fifteen-minute quiz. Papers of previous lecture taken up.

- a.* Judge Advocate General's Department.
- b.* Quartermaster Department (papers made in course on quartermaster papers).

Fifteenth lecture: Fifteen-minute quiz.

- a.* Quartermaster Department continued.
- b.* Ordnance Department (papers made out in course on Ordnance papers).
- c.* Medical Department.
- d.* Engineer Corps—Signal Corps.

Sixteenth lecture: Oral quiz on the entire course.

Seventeenth lecture: Oral quiz on the entire course.

Eighteenth lecture: Written quiz on the entire course.

MANUAL FOR COURTS-MARTIAL

First lecture:

- a.* Source and kinds of military jurisdiction.
- b.* Classification of courts-martial.
- c.* Composition.

Second lecture: Fifteen-minute quiz.

- a.* General courts-martial.
- b.* Special courts-martial.
- c.* Summary courts-martial.

Third lecture: Fifteen-minute quiz.

- a.* Courts-martial jurisdiction.
- b.* Arrest and confinement.

Fourth lecture: Fifteen-minute quiz.

- a. Preparation of charge (specimen charges, p. 335).
- b. Action upon charges.
- c. Charges to be made out.

Fifth lecture: Fifteen-minute quiz.

- a. Courts-martial organization.
- b. Challenges.
- c. Arraignment.

Sixth lecture: Fifteen-minute quiz.

- a. Witnesses and depositions.
- b. Evidence.

Seventh lecture: Fifteen-minute quiz.

- a. Evidence continued.
- b. Charges to be made out.
- c. Maximum limits (p. 161).
- d. Forms for sentence (p. 369).

Eighth lecture: Written quiz.

EXAMINATION OF RECRUITS

1. Lecture:

- Army surgeon's responsibility to Government.
- Place for examination.
- Supplies for examination.
- Rules for examination—Tripler's Manual—Circulars, W. D., etc.

2. Lecture:

- Physical examination—head, chest, abdomen, etc.
- Rules for rejection of recruits.

3. Lecture: Physical examination continued.

4. Lecture and oral quiz: Papers—enlistment papers, service records, examination blanks, surgeon's certificate of disability, identification card, etc. Practice in filling out blanks.

5. Shoe fitting:

- Lecture and demonstration.
- The foot and the Army shoe (Munson).
- Practical methods of shoe fitting.

6. Shoe fitting:

- Lecture and demonstration.
- Practical shoe fitting.

7. Finger prints:

- Lecture and demonstration.
- Value of finger prints for identification.
- Demonstration of method.

8. Finger prints: Practice in taking finger prints.

9. Quiz: Written quiz on entire course.

PREVENTION OF CONTAGIOUS DISEASES

1. Demonstration of inspection, methods of handling active cases of exposed men, Schick test, etc. To sections of class—each one period—7 to 9 a. m.

2. Practical work in inspection, etc., for a period of one week. To sections of class—two periods daily, 7 to 9 a. m. and 3 to 5 p. m.

REGIMENTAL MEDICAL SUPPLIES

1. (a) Position of regimental sanitary troops in relation to other units, ambulance companies, field hospital companies, etc.

(b) Personnel: Officers—enlisted men—bandsmen.

(c) Duties of regimental detachments:

- 1. Officers—in camp—on the march—in combat.
- 2. Enlisted men.
- 3. Bandsmen.

4. General: Maintenance of fighting units. Difference from civil practice.

2. Explanation of tables: Expendable and nonexpendable (A. B. and C.).
3. First-aid packet—carried by every officer and enlisted man.
4. Officers' belts, contents of:
 - (a) Practical demonstration of belt and contents.
 - (b) Diagnosis tag. Proper method of making out.
5. Belt, hospital corps. Practical demonstration.
6. Regimental combat equipment:
 - (a) Practical demonstration, packing and unpacking mule.
 Setting up of regimental aid station.
 Showing contents of chest.
 Demonstration of Lyster bag.
 Hypochlorite from quartermaster.
 - (b) Explanation of—when and where set up, and class of work done there.
 - (c) Litters and where obtained. How carried.
 - (d) Nine boxes of dressings. How carried.
 - (e) How replenished—
 1. In camp.
 2. In combat.
7. Camp infirmaries:
 - (a) Equipment weight:
 - (b) Purposes when used—in camp—in combat.
 - (c) How transferred.
 - (d) Personnel attached.
 - (e) Notification as to location when serving other units. Camp infirmary reserve.
 Division of equipment for two or more parties of regimental or camp infirmaries.
8. Regimental hospital:
 - (a) Purposes.
 - (b) When used.
9. Accountability and responsibility for supplies of detached battalions.

DEMONSTRATION OF TRENCH SYSTEM

First Day: Lecture with blackboard demonstration

1. General outline of trench system:
 - (a) Firing trenches.
 - (b) Support trenches.
 - (c) Reserve trenches.
2. Location of system:
 - (a) Chosen.
 - (b) Forced position.
3. Trace of trenches:
 - (a) Enfilade.
 - (b) Defilade.
4. Wire:
 - (a) Types.
 - (b) Positions—
 1. In front of trenches.
 2. At sides.
 - (c) Lanes.
 - (d) Repair.
5. Depth and contour of trenches.
6. Brief description of difference between French and British systems.
7. Location of sanitary formations:
 - (a) Local dressing stations.
 - (b) Regimental aid stations.
8. Location of sanitary appliances:
 - (a) Latrines.
 - (b) Kitchens.
 - (c) Water shelters.

9. How water and food are carried to trenches; waste is carried out.
10. Gas alarms.
11. Electric lights and telephones.

Second day

1. Description of position. Location of enemy line of firing and reserve trenches.
2. Different steps in building a trench:
 - (a) Laying out trace.
 - (b) Posts in position.
 - (c) Wire laid.
 - (d) Trench dug.
 - (e) Trench sloped.
 - (f) Ditch for revetting poles.
 - (g) Woven revetment placed.
 - (h) Revetment braced back and tied.
 - (i) Ends of poles cut off.
 - (j) Central drainage ditch dug.
 - (k) Miniature piles driven.
 - (l) Walk laid.
3. Approach trench described and shown.
4. Sniper's pit:
 - (a) Size.
 - (b) Sand-bag revetment.
 - (c) Overhead cover.
 - (d) Loop holes.
 - (e) Field of fire.
 - (f) Camouflage.
5. British trench:
 - (a) Firing banquette.
 - (b) Slopes of wall.
 - (c) Sand bags—how laid.
 - (d) Head cover.
 - (e) Loop holes.
 - (f) Thickness of parapet.
 - (g) Field of fire.
6. French trench:
 - (a) Firing banquette.
 - (b) Amount of exposure of troops on firing step.
 - (c) Field of fire.
 - (d) Camouflage on British trench.
7. Exit of first drainage system:
 - (a) Built up paredos.
 - (b) Size of drainage ditch.
 - (c) Use of concrete.
 - (d) Thickness of concrete used.
8. Traverse protecting entrance to covered trench.
9. Covered trench:
 - (a) Height.
 - (b) Width.
 - (c) Lighting.
 - (d) Knife gate.
 - (e) Depth of overhead cover.
10. Surface drainage:
 - (a) Chute.
 - (b) Use of concrete.
11. Firing trench:
 - (a) Depth.
 - (b) Width.
 - (c) Height of concrete.

12. Traverse:
 - (a) Thickness.
 - (b) Depth of trench back of traverse.
 - (c) Width.
 - (d) Brush revetting.
13. Trace of trench with perpendicular walls.
14. Winding course of trench:
 - (a) Difficulty in litter transportation.
 - (b) Confusion in estimating distance and direction.
15. Exit on surface:
 - (a) Contour of lines.
 - (b) Disposal of surface water.
 - (c) Contour of parapets with view to concealment.
16. Approach trench to second line support.
17. Board revetment.
18. Small dressing station:
 - (a) Approach.
 - (b) Head cover over door—
 1. Against shell burst.
 2. For water shed.
 - (c) Roof of dressing station—
 1. Logs.
 2. Dirt.
 3. Logs.
 4. Dirt.
 5. Rock.
 6. Dirt.
 - (d) Timber support.
 - (e) Sump for drainage.
 - (f) Capacity.
 - (g) Type of cases handled.
19. Dugout dressing station:
 - (a) Traverse protecting door.
 - (b) Shaft—
 1. Depth.
 2. Revetment.
 3. Overhead cover.
 4. To shed water.
To protect from fire.
For concealment.
 - (c) Gallery—
 1. Gas curtains.
 2. Length.
 3. Timbering.
 4. Pitch.
 5. Construction of steps.
 6. Arrangement of electric lighting.
 - (d) Dressing station—
 1. Thickness of rood (25 feet).
 2. Timbering.
 3. Overhead planking.
 4. Side wall protection.
 5. Ventilation. How driven.
 6. Stove and stove pipe.
 7. Capacity.
 8. Drainage.

19. Dugout dressing station—Continued.
 - (d) Dressing station—Continued.
 9. Grenade trap.
 10. How extended.
 11. Lighting.
 - (e) Exit—
 1. Same as entrance.
 2. Necessity for both entrance and exit.
 3. Masked by curve in trench instead of traverse.
 4. Heavy log revetment.
20. Winding trench:
 - (a) Comparison with angular type.
 - Advantages.
 - Easier to pass.
 - Facility for better transport.
 - Difficulty to take in bombing attack.
21. Rabbit wire revetment:
 - (a) Combined rabbit wire and brush.
22. Latrine:
 - (a) Local trench—
 1. Raised 1 foot.
 2. Entrance concreted to prevent wearing down.
 - (b) "T" head construction.
 - (c) Width of trench to latrine.
 - (d) Roof of latrine—
 1. Open to provide access of light, sun, and air.
 2. Layer construction.
 - (e) Cubicles for seats—
 1. Concreted on bottom.
 2. Raised 3 inches from floor of trench.
 - (f) Type of seats—
 1. Seat on top of oil tin.
 2. Double boxed.
 3. For bucket.
 4. With legs.
 5. Single completely closed.
 - (g) Preparation of empty oil can for containers. Rope handles.
 - (h) Covers for filled cans.
 - (i) Urine tub with pole handle.
 - (j) How waste is carried out.
 - (k) Hints on sanitary care of latrine.
23. Water and wash room shelter:
 - (a) Overhead shelter.
 - (b) Walls.
 - (c) Floor concreted.
 - (d) Advantage of location.
 - (e) Water barrels.
 - (f) Wash-basin rack.
 - (g) Camouflage.
24. Electric wiring:
 - (a) When carried on trench wall.
 - (b) Conduits on trench crossings.
25. Flume over trench for surface water:
 - (a) Great necessity for disposing of surface water.
 - (b) Review of different systems of drainage used.
 - (c) Brief description of trench foot.

Third day at trenches

1. Questions: Review and added demonstration of parts of trenches not understood.
2. Brief talk on where men live and sleep.
3. Demonstration by a regimental detachment (enlisted):
 - (a) Five methods of taking a wounded man over the top.
 - (b) Handling litters around traverses.
 - (c) Difficulty in passing a litter through an occupied trench. How it may be avoided.
 - (d) Carrying a litter into and out of dressing stations of both types.
 - (e) Relative ease of transport through winding trench (circular).

REGIMENTAL DETACHMENT

First day. Use and internal administration

1. Size:
 - (a) Infantry.
 - (b) Cavalry.
 - (c) Field Artillery.
2. Duties in permanent camp:
 - (a) Care of infirmary—
 1. Description of infirmary building found in cantonments.
 2. Dressing room attendants.
 3. Dispensary attendant.
 4. Medical officer of the day.
 5. Kitchen.
 6. Ward—attendants.
 7. Squad room—
 - Alignment of cots.
 - Arrangement of cots.
 - Arrangement of equipment on Saturday.
 - Inspection.
 - Cuspidors.
 - Cleanliness.
 - Airing bedding.
 - (b) Sick call—
 1. Noncommissioned officer in charge of blotter.
 2. Clerk posting sick books.
 3. Attendant to take temperature.
 4. Two attendants. Dressings.
 5. Noncommissioned officer dispensing.
 6. Orderly to arrange sick incoming.
 7. Orderly to send out sick attended to.
 - (c) Typhoid prophylaxis—
 1. Attendant to arrange men in line as they appear on record.
 2. Attendant to spot arms with iodine.
 3. Noncommissioned officer clerk to check names on record.
 4. Attendant to boil needles.
 5. Attendant to fill syringes.
 6. Medical officer to give prophylaxis.
 7. Attendant to spot arms with iodine.
 8. Attendant to hasten orderly departure of men completed.
 - (d) Sanitary inspection—
 1. Noncommissioned officer of kitchens and latrines.
 2. Privates first class of latrines.
 3. Instructed carefully to report, not criticize.
 - (e) Duties of noncommissioned officer in charge of quarters.
 - (f) Instruction as per schedule. Importance of being earnest in all instruction.

Second day

3. Duties on the march:

(a) Before march begins—

1. Check supplies. Diagnosis tags.
2. Review duties to insure smooth performance.
3. Check carts, wagons, and all mule shoes.

(b) At start—

1. Absolute and correct promptness.
2. Be at detachment 20 minutes before time.
3. Verify watch with adjutant.

(c) During march—

1. Position in column—

- (a) Noncommissioned officer to each battalion.
- (b) One private to each company.
- (c) Balance in reserve at rear.

2. Position of medical officers—

- (a) Surgeon with commanding officer.
- (b) Two medical officers with each battalion.

3. Care of sick—

- (a) Must be seen by medical officer.
- (b) Must be cared for by Hospital Corps men.
- (c) Care to avoid overloading transportation.

4. Care of footsore—

- (a) Everybody's feet are sore.
- (b) Utilize halts.
- (c) Privates, Medical Department, must act as instructors to men.

5. Restrict passes to transportation—

- (a) Use utmost care that no sick man is forced to walk.

6. Care of water—

- (a) Allow use of no water from local sources unless known.
- (b) Post one private, Medical Department, at water to inform all company commanders that water is not safe.

7. Care during halts—

- (a) Allow no straying.
- (b) Loosen clothing.
- (c) Sit down and elevate feet when possible.
- (d) Drink water sparingly.

8. Save your men every needless fatigue. Utilize every moment of rest.

(d) At conclusion of march—

1. One junior medical officer and one private supervise water from local sources.
2. One junior medical officer supervises care of regimental water carts.
3. Two noncommissioned officers supervise digging of straddle trenches after site is selected.
4. Regimental surgeon obtains information as to hour when infirmary is available for his regiment.
5. Hold sick call rapidly, using 5 medical officers, 2 noncommissioned officers, and 10 privates.
6. Care of feet. Men must act as advisers, rather than attempt to care for every sore foot. All serious cases to be seen by medical officer.
7. Litter no cases unless absolutely necessary. Carry no litters by hand.
8. Before nightfall put out such dressings as may be necessary for morning, and pack remainder.
9. See that your men get plenty to eat, plenty of rest, and a good night's sleep.

Third day

4. During combat, open fighting:

NOTE.—To be taken up in detail on the actual terrain on maneuvers.

(a) Position during combat—

1. Noncommissioned officer to each battalion.
2. One private to each company.
3. Balance in reserve—

a. To get part of line worst punished.

b. To act as stretcher bearers.

(b) Position of aid station (brief, covered in other courses).

(c) Labor involved in litter transportation.

(d) Do not spare your men. Drive to limit of their strength.

5. During trench warfare:

NOTE.—To be taken up in detail in trenches during demonstration of trench system.

(a) Position—

1. Small dressing station.
2. Local dugouts.
3. Regimental aid station.

(b) Wounded evacuated on litter—

1. Never removed from litter from time they are laid on it.

(c) Evacuated after nightfall.

(d) No corps men in trenches until called from dugout.

(e) Practice in work with gas masks on.

(f) Absolute training for care of gassed cases.

Fourth day

6. Company punishment:

- (a) Reprimand.
- (b) Restriction.
- (c) Kitchen police.
- (d) Unpleasant fatigue.
- (e) Extra and special form of fatigue.
- (f) Courts-martial.

7. Reward the worthy.

8. Study each individual soldier and know every peculiarity and weakness before combat begins.

9. Keep your men constantly occupied.

10. Amusements and athletics.

11. Allow no officer from another organization to reprimand your own men.

12. Allow no dereliction of duty to go unpunished.

13. Punish every failure to salute any officer or any discourtesy shown to a sick man.

14. Allow no sloppy dress or behavior. Keep your men smart and alert.

15. Back your noncommissioned officers to the limit.

16. Allow no noncommissioned officer to abuse, hector, or tyrannize over the men.

17. Never raise the voice when reprimanding a man. Never show temper.

18. Set your men an example of what they should do:

1. In deportment.
2. Dress.
3. Punctilious performance of every duty.
4. Exact performance of duty.
5. Promptness.

EQUITATION

The ultimate aim of the course was that each officer should have a strong seat, be able to correctly apply the aids, be capable of covering distance with the least fatigue to himself and horse, and be able to ride broken country.

First month

First week:

- To fold the saddle blanket.
- To put on the blanket and sureingle.
- To put on and take off the watering bridle.
- To saddle.
- To unsaddle.
- To put on and take off the bit and bridoon bridle.
- Stand to horse.
- To lead out.
- Stirrups.
- To mount.
- To dismount.
- To take the reins in the hand and separate them.
- Position of the trooper mounted.
- Supplying exercises.
- To rest.
- Dismiss.
- Stand to heel.
- Mounted exercises at the walk.

Second week:

- Repetition of the first week and added—

- To gather the horse.
- To move forward.
- To halt.
- The trot.

Third week:

- Repetition of the first and second week and added—

- By the right and left flank.
- The oblique by trooper.
- General provisions regarding work on the track.
- Marching upon fixed points and a designated objective.
- Circling.

Fourth week:

- Repetition of the first, second, and third weeks and added—

- The gallop.
- The gallop depart.
- Changes of gait.
- To change hands.
- Supplying exercises, mounted.
- Posting.
- Care of horses and saddlery.

Second month

Repetition of the work of the first month, increasing the severity and difficulty of all exercises, and added—

- Points of the horse.
- Rules for the care of horses.
- Stables and stable management.
- Stable duty.
- Grooming.
- Watering.
- Feeding.
- Exercising.
- Sick horses.
- Shoeing.

Third month

Repetition of the work of the first and second months, requiring proficiency in all exercises, and added—Jumping.

SYNOPSIS OF COURSE OF INSTRUCTION IN MILITARY HYGIENE AND SANITATION, SANITARY INSPECTION, CIVIL FUNCTION OF MEDICAL DEPARTMENT IN OCCUPIED TERRITORY

CHAPTER I

Hygiene and sanitation, 20 hours; lectures and recitations on subject matter on the following heads:

1. Introduction.
 - Importance of subject.
 - Definitions.
 - Responsibility of medical officers and authority for actions.
 - Morbidity and mortality rates in civil communities, in military service, past and present, in peace and in war.
 - Influence affecting mortality rates in military service.
 - Common diseases in war, past and present.
 - Character of wounds in modern war.
2. The recruit.
 - Standards—physical, mental, and moral.
 - Training—effect, methods, objects to be attained, dangers of overtraining.
 - Personal hygiene.
3. Food.
 - Principles and constituents, nutritive function and value of each.
 - Rations; kind issued; nutritive value and use of each.
 - Field cooking.
4. Clothing and equipment.
 - Brief description of articles issued and used in the military service.
5. The march.
 - Distance, speed, duration, steps, and attitude.
 - Energy distribution and heat dissipation at rest, on march.
 - Water supply.
 - Regulation and discipline.
 - Sanitation on the march.
6. Quarters, barracks, cantonments.
 - Air—constituents and requirements, floor space, ventilation, heating.
 - Care of barracks, guardhouse, kitchens, mess room, etc.
 - Hospitals.
7. Camps.
 - Semipermanent, temporary, bivouac.
 - Location; sanitary survey of camp sites.
 - Soil—physical properties, purification, soil bacteria, etc.
 - Sanitation of camp—police, kitchens, latrines, bathing and washing, disposal of wastes, garbage, refuse, manure, etc.
 - Sanitary orders—form, purpose, scope.
 - Hygiene of the battle field.
 - Trench hygiene and sanitation, disposal of the dead, etc.
8. Water.
 - Amount required.
 - Occurrence in nature.
 - Examination of water—external qualities, chemical, microscopical, bacteriological
 - Purification—heat, chemical, mechanical, biological.

9. Sickness in the Army.

Cause—infective agencies, contact, carriers, etc.; agencies concerned in transmission.

Animals and insects concerned in transmission of disease:

Mosquitoes.....	} Classification, life cycle, habits. Rôle in transmission of disease. Methods of combating.
Flies.....	
Fleas.....	
Lice.....	
Bugs, etc.....	

Diseases transmitted by insects by direct inoculation—malaria, yellow fever, dengue, plague, typhus, filariasis, etc.

Diseases of infective intestinal type—typhoid, dysenteries, cholera, etc. Method of transmission, epidemiology, etc.

Diseases of infective respiratory type—the exanthemata, pneumonia, cerebrospinal fever, diphtheria. Method of transmission, epidemiology, etc.

Miscellaneous and deficiency diseases—scurvy, beri-beri, trench diseases, heart diseases, nervous diseases, alcoholism, etc.

CHAPTER II

Sanitary inspection, two hours; individual instruction.

Class divided into squads and given practical demonstration of matters to be investigated, and noted in making a sanitary inspection. Each individual then required to make a sanitary inspection and render a report thereof.

CHAPTER III

Civil function of Medical Department in occupied territory, one hour; subject covered in one lecture.

CHAPTER IV

Practical demonstration in laboratory of field sanitary appliances, six hours.

Class divided into squads, individuals given practical demonstration in construction and use of sanitary appliances. Individuals required to make and submit drawings of approved types of incinerators, latrines, field cooking apparatus, and sanitary appliances used in the field and in semipermanent and temporary camps, etc.

SYNOPSIS OF COURSE IN MILITARY SURGERY

LECTURE I

Projectiles and ballistics

Varieties of projectiles used in the belligerent armies:

Bullets—similarities and differences in structure, velocity, behavior, and effect of

German, French, English, Belgian, and American bullets at different ranges.

Shells—Construction, behavior, and effect of high explosives and shrapnel. Types of fuzes.

Miscellaneous projectiles—Bombs, grenades (hand and rifle), etc.

LECTURE 2

Wounds and wound treatment

Characteristics of injuries produced by bullets, shells, bombs, grenades, etc., upon various tissues:

Infection—

Prevalence and the factors responsible for it.

Pathologic and bacteriologic considerations.

Clinical features and manifestations.

Treatment—general principles; infection and the methods of dealing with it, based upon the experience of this war; discussion of different methods and their use.

LECTURE 3

Antisepsis and antiseptics

Chemistry and therapeutic employment of different antiseptic substances.

LECTURE 4

Gas infection—prevalence; factors involved in its production; pathologic and clinical manifestations; principles of treatment.

Tetanus: Prevalence; prophylactic and therapeutic measures employed; delayed tetanus.

Trench foot: Prevalence; factors involved in its production; pathology; principles of treatment; prophylaxis.

LECTURE 5

Wounds of the abdomen, chest, and head

Prevalence; characteristics; climatical manifestations; complications; principles of treatment.

Wounds of the buttocks

Principles of, and factors complicating treatment.

LECTURE 6

Fractures

Character of fractures encountered; prevalence of infection; complicating factors influencing treatment; principles of treatment; discussion of methods and splints used for transportation and treatment; after treatment.

LECTURE 7

Joint injuries

Characteristics (clinical appearance and manifestations).

Principles of, and factors complicating treatment; after treatment.

Amputation

Indications; types of amputations and discussion of their advantages; the "flapless amputation"; amputations in relation to the subsequent use of artificial limbs.

Resections

Indications; discussion of resections in relation to infected fractures.

LECTURE 8

Localization and extraction of projectiles

Methods of localization and their use. Extraction of projectiles; when to extract them and when to leave them.

Plastic surgery

Types of wounds requiring plastic repair; clinical and therapeutic considerations; Thiersch grafts; whole skin grafts; bone grafts in ununited fractures; transplantation of fat to fill in retracted scars; facial transplants in nerve suture, etc.

LECTURE 9

Evacuation of the wounded from the front

Problems involved in bringing in wounded from No Man's Land to dressing station; attention given at dressing station; conditions under which men are wounded and brought back as influencing their condition and the course and treatment of their injuries. The work of a field hospital; condition under which patients are received and the work done.

Evacuation hospitals; their function and factors influencing the work done. Evacuation of wounded from evacuation hospital to base; conditions at base. Convalescent hospitals; special hospitals for after treatment of fractures and joint cases; mechano-therapy; electro and hydro therapy; etc.

ORTHOPEDIC INSTRUCTION

LECTURE 1

The human foot: Its anatomy, physiology, examination, and the significance of its abnormalities. Symptoms and signs. Limitations of flexion. Abduction and pronation. Eversion, inversion. Low arches. Flat feet. Prominent scaphoid arthritis.

LECTURE 2

Quiz and recitations (Munson), one hour.

LECTURE 3

The disabilities of the soldier's foot and their treatment. Acute foot strain. Treatment, acute foot strain. Purpose, application. Further treatment. Ordinary foot strain. Flaccid feet. Rigid feet. Spastic feet. Flat feet. Treatment. Osseous flat foot. Affections of the anterior arch.

Callouses on sole over the metatarsal heads. Metatarsalgia treatment. Affections of the regions of the heel involving the tendo achillis. Involving os calcis. Treatment. Hallux rigidus, hammertoe, treatment. Deformities of the little toe.

Period 4: Quiz and recitations (Munson), one hour.

Period 5: Clinic, one hour.

Period 6: Shoe fitting for abnormal feet, one hour.

Period 7: Examination, one hour.

COURSE IN FIRST AID

Lecture (two hours)

1. Modern definition of first aid:
 - a. First aid in its relation to minor surgery.
 - b. Improvised minor surgery at aid and dressing stations.
2. The first-aid packets, application, results.
3. Cardinal conditions to be treated:
 - a. Hemorrhage—use of the tourniquet.
 - b. Shock—morphine and atropine, immobilization of patient.
 - c. Fatigue—hot drinks—rest—wounds (complicated with burns, etc., use antitetanic serum).
4. Effects heat and cold—treatment.
5. Dislocations and fractures—improvised dressings and splints as found in men's equipment and in the field.
6. Necessity for having trained assistants who know your personal ideas on treatment and handling of wounded.

MEDICAL DEPARTMENT IN CAMPAIGN

Eight hours were devoted to the study of the Medical Department in campaign, following the subject as outlined in the textbooks.²²⁴

A thorough knowledge of map reading was essential, and special emphasis was laid on the subject of orders, the student being impressed with paragraph 4, pertaining to the Medical Department.²²⁴

²²⁴ (1) Straub, Paul Frederiek, major, M.C.: *Medical Service in Campaign. A Handbook for Medical Officers in the Field*, Philadelphia. P. Blakiston's Son & Co., 1912, second edition.

(2) Munson, Edward Lyman, major, M.C.: *The Principles of Sanitary Tactics. A handbook on the Use of Medical Department Detachments and Organizations in Campaign*. Banta Publishing Co., Menasha, Wis., 1911.

A short course of instruction was given on the examination of lungs for tuberculosis, concerning which the details are outlined under special courses of instruction for officers.²²³

Profile making was well demonstrated, and the student was required to hand in a profile of some part of the map. The subject of overshots was dwelt upon and each student was required to hand in several problems to show that the subject was well understood.²²⁴

The next course included a study of each of the different stations established by the Medical Department, the internal administration, personnel and the conditions under which they are established; the line of communications with its different sections, the components of each section, and how the different zones related to each other.²²⁵ A chart was placed on the blackboard for each class, showing the zone of advance and the zone of the line of communications, and the component parts of each zone and how they operate.

Each student was quizzed on the lectures as given, and if the instructor thought necessary an examination was held at the end of the course, each man being graded accordingly.

PRINCIPLES OF SANITARY TACTICS

Twelve hours were devoted to the principles of sanitary tactics. In so far as visibility is concerned this subject was covered by means of projecting the line of sight and solving the problem by mathematics and by the profile method; each student was required to solve problems by both methods.²²⁶ The student was given enough instruction in tactics pertaining to the line to enable him to have an enlightened idea of what the commander of the forces was trying to do and to intelligently cooperate with him and give the proper instructions to his sanitary troops. The smallest unit (the battalion) was first studied both in advance, retreat, and defensive formations, explaining the use, position, and personnel of the sanitary troops. The regiment, the brigade, and the division were next studied, always laying particular stress upon the use of the sanitary personnel. The 12-inch map of Leavenworth was placed in front of the class and the position of the different units pinned on with the war game sets, and each student was required to show where he would establish his aid and dressing stations, the stations for the field hospitals, how the line of communications was brought in, how to trace a wounded man from the front to the rear, showing what organization he passed through and what records were made and the disposition made of him. Road space and the factor of time were emphasized. Students were quizzed upon each problem. A student was placed at the board, required to make a solution on the map and give his reasons. The rest of the class had their maps and followed his solution. When he finished each man in the class was asked to criticise his solution.

MAP PROBLEMS

Four hours were given to the study of map problems.²²⁷ A problem was given to the class, which was taken out and shown the terrain over which the problem was to be worked. Each man, individually, then worked his problem, wrote it out, and handed it in to the instructor.

WAR GAMES

Eight hours were devoted to this subject. The students had their maps, the large 12-inch map was put upon the wall, a problem was given to them, and students were designated to act as the chief surgeon, sanitary inspector, regimental surgeon, directors, and commanders of ambulance companies and field hospitals.²²⁴ Orders were written and given verbally and the students took sides, one side worked the problem and the other side criticized and vice versa.

BASIC COURSE

The following schedule of one week's work in the basic course shows the method of assignment of hours and instructors:²²⁵

HEADQUARTERS MEDICAL OFFICERS' TRAINING CAMP, FORT RILEY, KANS.

Schedule of instruction for the week ending May 25, 1918—Company No. 26

Monday, May 20:

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	War psychoses, neuroses, shell shock, etc.
10.30 to 11.30 a. m.	Orthopedics.
1 to 1.50 p. m.	Medical Department in Campaign (Assembly Hall C-4).
2 to 2.50 p. m.	Poison gases and liquid fire, etc.
3 to 3.50 p. m.	Ambulance company equipment, use and internal administration.
4 to 4.50 p. m.	Ambulance company equipment, use and internal administration.

Tuesday, May 21:

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Poison gases and liquid fire, etc.
10.30 to 11.30 a. m.	Orthopedics.
1 to 1.50 p. m.	Medical Department in Campaign (Assembly Hall C-4).
2 to 2.50 p. m.	Manual for Courts-Martial and Military Law.
3 to 3.50 p. m.	Ambulance company equipment, use and internal administration.
4 to 4.50 p. m.	Ambulance company equipment, use and internal administration.

Wednesday, May 22:

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Camp gymnasium.
9.30 to 10.20 a. m.	Manual for Courts-Martial and Military Law.
10.30 to 11.30 a. m.	Medical Department in Campaign (Assembly Hall C-4).
1 to 1.50 p. m.	Principles sanitary tactics (Assembly Hall C-4).
2 to 2.50 p. m.	Principles sanitary tactics (Assembly Hall C-4).
3 to 3.50 p. m.	Military surgery.
4 to 4.50 p. m.	Orthopedics.

Thursday, May 23:

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Manual for Courts-Martial and Military Law.
10.30 to 11.30 a. m.	Orthopedics.
1 to 1.50 p. m.	Military surgery.
2 to 2.50 p. m.	Civil sanitary function Medical Department in occupied territory.
3 to 3.50 p. m.	Principles sanitary tactics (Assembly Hall C-4).
4 to 4.50 p. m.	Principles sanitary tactics (Assembly Hall C-4).

Friday, May 24:

- 7.30 to 7.50 a. m.----- Physical drill.
- 8 to 9.20 a. m.----- Drill.
- 9.30 to 10.20 a. m.---- Manual for Courts-Martial and Military Law.
- 10.30 to 11.30 a. m.--- Orthopedies.
- 1 to 1.50 p. m.----- Military surgery.
- 2 to 2.50 p. m.----- Civil sanitary function Medical Department in occupied territory.
- 3 to 3.50 p. m.----- Principles sanitary tactics (Assembly Hall C-4).
- 4 to 4.50 p. m.----- Principles sanitary tactics (Assembly Hall C-4).

Saturday, May 25:

- 7.30 to 7.50 a. m.----- Physical drill.
- 8 to 9.20 a. m.----- Inspection, followed by drill.
- 9.30 to 10.20 a. m.---- Manual for Courts-Martial and Military Law.
- 10.30 to 11.20 a. m.--- Field hospital equipment, use and internal administration.

WEEKLY AIRDROME AND ASSEMBLY HALL ASSIGNMENT

Classroom work, Company 26, held at airdrome No. 3, except as noted above, unless otherwise directed by an instructor for his subject.

During inclement weather inside classroom work held at Assembly Hall C-1.

SPECIAL INSTRUCTION FOR OFFICERS

In December, 1917, instructions were received to establish schools in military roentgenology²²⁶ and military orthopedies.²²⁷ The officers ordered to take these courses were designated by the chiefs of these departments in the Office of the Surgeon General. Each course consisted of four weeks' basic training and four weeks' training in the special subject covered.

SCHOOL OF MILITARY ROENTGENOLOGY

The following letter of instructions from the Surgeon General gave the outline for the establishment of this school:²²⁶

WAR DEPARTMENT,
OFFICE OF THE SURGEON GENERAL,
Washington, December 6, 1917.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Riley, Kans.

Subject: School in military roentgenology.

1. A school in military roentgenology will be established as a special course for selected student officers, as part of the general scheme of instruction carried out in your medical officers' training camp.

2. The purpose of this school is to conduct training in roentgenology along military lines, from the military viewpoint, and in the military environment; and coincidently to develop its officers physically and train them in subjects which they should know under the conditions in which they would practice their specialty, including regulations, paper work, handling of men, and functions of medical officers other than those with fighting troops. By operating it as part of the training plan, much mileage can be saved and the presence of a large number of officers from whom to select will improve personnel.

3. About 60 roentgenologists will be required monthly. Classes should be arranged for on the following basis: At Medical Officers' Training Camp, Fort Oglethorpe, 35; at Medical Officers' Training Camp, Fort Riley, 25.

4. The instructor in roentgenology detailed by this office on the staff of instructors of the training camp will, under the supervision of the commandant thereof, be in direct charge of the course.

In addition to his educational duties, he will continuously investigate the qualifications and availability of medical officers under general training relative to detail for training as Roentgenologists.

5. The Roentgenologist on duty at the hospital will serve as assistant instructor, and his routine work at the hospital will as far as possible be arranged to that end. It is important that such routine duties should be demonstrated and utilized as part of the subjects of instruction.

6. To prevent duplication of apparatus, and to take full advantage of existing facilities and the many opportunities for clinical work, the course in military Roentgenology will be conducted in connection with the Roentgen laboratories of the base hospitals at Fort Oglethorpe, Ga., and Fort Riley, Kans.

7. The commanding officer of each of the above base hospitals will take measures to provide the necessary apparatus and equipment and will facilitate the work of training in every way.

8. The general instruction to be given will relate to the handling of apparatus, general methods of work, and normal X-ray anatomy.

Detailed information as to the general nature and scope of the work to be done will be furnished by the X-ray division of this office.

The course of instruction in Roentgenology, based thereon, will be prescribed by the commandant of the training camp after conference with the instructor in Roentgenology.

9. The course in general training and Roentgenology will cover a minimum of two months. In addition to instruction in other subjects, the course in Roentgenology comprises a total of 80 hours, covering 4 hours daily for 5 days each week of the second month.

10. No officer will be detailed for special training in Roentgenology until he shall have completed one month's course of general instruction in the training camp as prescribed in this letter.

Officers who qualify in this course, and are otherwise satisfactory, will be recommended for detail for the final course in New York City or elsewhere.

11. Student officers who, after one week's instruction, do not give evidence of proper aptitude for the work, will be returned to the general instruction in the training camps and other officers assigned in their places.

12. Officers under training as specialists in military Roentgenology will be quartered, and subsisted in the medical officers' training camp and subject to its discipline at all times.

13. Hours of instruction in Roentgenology will be arranged by agreement between the commandant of the training camp and the commanding officer, base hospital.

14. The schedule for the first month is as follows:^b

* * * * *

15. The schedule for the second month is as follows:^b

* * * * *

16. The receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. MUNSON, *Colonel, Medical Corps.*

The first course began January 28, 1918.²²⁸ All officers reserved by the Surgeon General's Office and all others desiring this type of work were first examined by the director of the school, and those qualified to take the course were detailed for instruction.²²⁸ At this examination, if any officers were found qualified to take the advanced course they were reported to the Surgeon General's Office. The first four weeks as contemplated by instructions issued by the Surgeon General consisted of essentially the same subjects as those taught in the basic course, but with the difference that fewer hours were devoted to some subjects and others of importance to these officers introduced. In the second month 100 hours, including drill periods, were devoted to more or less military instruction of a general nature, and the remaining time (80 hours) was

^b See pp. 78, 79.

taken up by special instruction in Roentgenology. This time for X-ray instruction was afterwards increased to 108 hours.

The training given consisted of instruction in the fundamental physics of the X-ray, normal and pathological anatomy, common injuries and dislocations, lesions of the lungs and heart, the common diseases of the gastrointestinal tract, the principles involved in the localization of foreign bodies, familiarity in the use of the base hospital equipment and dark-room technique.²²⁸

Some of the trained Roentgenologists who were qualified to take charge of a Roentgenology department, desired to have more training along diagnostic lines.²²⁹ To help these officers the director gave a series of three lectures a week, using evening hours. These lectures were well attended.

In this work the X-ray department at the base hospital, Fort Riley, was utilized and several adjoining rooms were used as classrooms.²²⁸

In addition to the regular classes in the school, 60 officers who were reported as trained Roentgenologists and assigned to this camp for military training were examined and those found not proficient were given further instruction in this branch.²²⁹

The school was closed May 9, 1918.²¹⁹

The following is a copy of the schedule provided for this school for one six-day period:²³⁰

Schedule of instruction for week ending March 16, 1918, fifth week.

THIRD SCHOOL FOR MILITARY ORTHOPEDICS AND ROENTGENOLOGY

(Designated Student Officers Companies Nos. 19 to 23, inclusive)

MONDAY, MARCH 11

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Military hygiene and sanitation.
10.30 to 11.30 a. m.	Military hygiene and sanitation.
1 to 4.50 p. m.	Orthopedics (School for Military Orthopedics, south end mess hall, F. H. 16).
1 to 4.50 p. m.	Roentgenology (School for Military Roentgenology, section E, base hospital).

TUESDAY, MARCH 12

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Military hygiene and sanitation.
10.30 to 11.30 a. m.	Principles sanitary tactics (assembly hall C-4).
1 to 4.50 p. m.	Orthopedics (School for Military Orthopedics, south end mess hall, F. H. 16).
1 to 4.50 p. m.	Roentgenology (School for Military Roentgenology, section E, base hospital).

WEDNESDAY, MARCH 13

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Military hygiene and sanitation.
10.30 to 11.30 a. m.	Principles sanitary tactics (assembly hall C-4).
1 to 4.50 p. m.	Orthopedics (School for Military Orthopedics, south end mess hall, F. H. 16).
1 to 4.50 p. m.	Roentgenology (School for Military Roentgenology, section E, base hospital).

THURSDAY, MARCH 14

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Military hygiene and sanitation.
10.30 to 11.30 a. m.	Principles sanitary tactics (assembly hall C-4).
1 to 4.50 p. m.	Orthopedics (School for Military Orthopedics, south end mess hall, F. H. 16).
1 to 4.50 p. m.	Roentgenology (School for Military Roentgenology, section E, base hospital).

FRIDAY, MARCH 15

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	Principles sanitary tactics (assembly hall C-4).
10.30 to 11.30 a. m.	Military hygiene and sanitation.
1 to 4.50 p. m.	Orthopedics (School for Military Orthopedics, south end mess hall, F. H. 16).
1 to 4.50 p. m.	Roentgenology (School for Military Roentgenology, section E, base hospital).

SATURDAY, MARCH 16

7.30 to 7.50 a. m.	Physical drill.
8 to 9.20 a. m.	Drill.
9.30 to 10.20 a. m.	War psychoses, neuroses, shell shock, etc.
10.30 to 11.30 a. m.	Military hygiene and sanitation.

WEEKLY ASSEMBLY HALL ASSIGNMENT

Inside classroom work held in north end of barracks No. 1, except as noted above, unless otherwise directed by an instructor for his subject.

SCHOOL OF MILITARY ORTHOPEDICS

The School of Military Orthopedics was established in accordance with instructions from the Surgeon General.²²⁷ The first course began in January, 1918.²³¹ When this course started, quarters for instruction were furnished at the base hospital, Fort Riley. A four weeks' course covering intensive instruction in this work was the basis for the school, but especially qualified men were kept on longer to round out such special lines of work for which they were best suited.²³¹

The letter from the Surgeon General which ordered the establishment of the school gave a clear outline of the instruction to be given it.²²⁷

DECEMBER 7, 1917.

From: The Surgeon General, United States Army.

To: Commandant, Medical Officers' Training Camp, Fort Riley, Kans.

Subject: School in military orthopedics.

1. A school in military orthopedic surgery will be established, as a special course for selected student officers, as part of the general scheme of instruction carried out in your medical officers' training camp.

2. The purpose of this school is to conduct training in orthopedic surgery along military lines, from the military viewpoint, and in the military environment; and coincidentally to develop its officers physically and train them in subjects which they should know under the conditions in which they would practice their specialty, including regulations, paper work, handling of men, and functions of medical officers other than those with fighting troops. By operating it as part of the training plan, much mileage can be saved, and the presence of a large number of officers from whom to select will improve personnel.

3. About 40 orthopedic surgeons will be required monthly. Classes should be arranged for on the following basis: At Medical Officers' Training Camp, Fort Oglethorpe, 25; at Medical Officers' Training Camp, Fort Riley, 15.

4. The instructor in orthopedic surgery detailed by this office on the staff of instructors of the training camp will, under the supervision of the commandant thereof, be in direct charge of the course.

In addition to his educational duties, he will continuously investigate the qualifications and availability of medical officers under general instructions relative to detail for training as orthopedic surgeons.

5. The orthopedic surgeon on duty at the hospital will serve as assistant instructor, and his routine work at the hospital will as far as possible be arranged to that end. It is important that such routine duties be demonstrated and utilized as part of the subjects of instruction.

6. To prevent duplication of apparatus and to take full advantage of existing facilities and the many opportunities for clinical work, the course in military orthopedic surgery will be conducted in connection with the orthopedic work of the base hospital at Fort Riley, Kans.

7. The commanding officer of the above base hospital will take measures to provide the necessary apparatus and equipment, and will facilitate the work of training in every way.

8. The general instruction to be given will relate to the principles of orthopedic surgery, the mechanics and fitting of apparatus, and the diagnosis and treatment of foot conditions.

Detailed information as to the general nature and scope of the work to be done will be furnished by the orthopedic division of this office.

The course of instruction in orthopedic surgery, based thereon, will be prescribed by the commandant of the training camp, after conference with the instructor in orthopedic surgery.

9. The course in general training and orthopedic surgery will cover a minimum of two months. In addition to instruction in other subjects, the course in orthopedics will comprise a total of 80 hours, covering 4 hours daily for 5 days each week of the second month.

10. No officer will be detailed for special training in orthopedic surgery until he shall have completed one month's course of general instruction in the training camp as prescribed in this letter.

Officers who qualify in this course, and are otherwise satisfactory, will be recommended for detail for the final course in New York City or elsewhere.

11. Student officers who, after one week's instruction, do not give evidence of the proper aptitude for the work, will be returned to general instruction in the training camps and other officers assigned in their places.

12. Officers under training as specialists in military orthopedics will be quartered and subsisted in the medical officers' training camp and subject to its discipline at all times.

13. Hours of instruction in orthopedic surgery will be arranged by agreement between the commandant of the training camp and the commanding officer, base hospital.

14. The schedule for the first month is as follows:^b

* * * * *

15. The schedule for the second month is as follows:^b

* * * * *

16. Receipt of this letter to be acknowledged.

By direction of the Surgeon General:

E. L. Munson, *Colonel, Medical Corps.*

The practical orthopedic work was taught at the base hospital, Fort Riley, where quarters were furnished this school.²³¹ A ward for 32 patients was set aside for orthopedic cases. One-half of one of the temporary two-ward buildings was assigned for the out-patient clinics and for classrooms for the school. A small room for cobblers was also provided. In addition to the patients in the hospital itself, an out-patient clinic, with an attendance of from 30 to 90 patients daily, was conducted. Several dissected upper and lower extremities were procured from the University of Nebraska for the use of the school.²³²

^b See pp. 78, 79.

The subject of orthopedic surgery was tabulated by the senior instructor, and from this tabulation the instruction was conducted, available clinical material being used to illustrate the different pathological lesions studied.²³³ The students were required, as far as possible, to make the necessary examinations, prepare and adjust splints, etc. After the course was completed student officers who were not immediately ordered away were used as assistants in the orthopedic department of the hospital.

In addition to the intensive course for the orthopedic specialists, the instructors attached to this school gave a short course in military orthopedics in the general basic course of the camp.²⁷

The following is an outline of the instruction:²⁷

Lecture 1 (one hour): The human foot—its anatomy, physiology, examination, and the significance of its abnormalities; symptoms and signs; limitations of flexion; abduction and pronation; eversion, inversion, low arches. Flat feet. Prominent scaphoid arthritis.

Quiz and recitations, Munson (one hour).

Lecture 2: The soldier's foot and the military shoe.

Lecture 3 (one hour): The disabilities of the soldier's foot and their treatment; acute foot strain; treatment, acute foot strain; purpose, application; further treatment; ordinary foot strain; flaccid feet; rigid feet; spastic feet; flat feet; treatment; osseous flat foot. Affections of the anterior arch. Callouses on sole over the metatarsal heads; metatarsalgia, treatment. Affections of the region of the heel involving the tendo achilles; involving the os calcis, treatment. Hallux rigidus, hammer toe, treatment. Deformities of little toe.

Quiz and recitations from Munson (one hour).

Clinic (one hour).

Shoe fitting (one hour).

Shoe alterations (one hour).

Lecture 4: Acute sprains, treatment; sequelæ of acute sprains; chronic sprains; peripheral nerve injuries; fractures and dislocations.

Lecture 5: Fractures and dislocations; their treatment; malunited and ununited; fractures and their treatment; transplantation of the bone and some uses of the bone graft.

Lecture 6: Disabilities of the knee joint. The mechanical treatment of fractures under war conditions.

Lecture 7: Orthopedic surgery in general: Necessity for the early application of the principles of orthopedic surgery to conserve function; preventing of deformities and obtaining best final result.

Lecture 8: War orthopedic surgery: Reconstruction, braces, prosthesis; positions of election ankylosis following gunshot injuries of joints.

Lecture 9: Suture of nerves and alternative methods of treatment by transplantation of tendons.

Lecture 10: The rehabilitation of the soldier mentally, physically, and occupationally.

SANITARY SCHOOL

In addition to the regular instruction in hygiene and sanitation given the training companies, a special course was conducted in order to train officers for the duty of sanitary inspectors, commanders of sanitary squads, etc.²⁰³ After two months' instruction in the basic course, officers were detailed to this school and given six weeks' instruction in practical sanitation. These officers were detailed as assistant sanitary inspectors in this camp and Camp Funston. They were required to make both general and special inspections and to turn in carefully written reports. All of their work was under the thorough super-

vision of well-qualified instructors, and after the reports of inspections were made the student was required to go over his own report and defend its recommendations.

Special demonstrations in practical sanitation, including inspections of dumps, water chlorination plant, excreta disposal systems, sanitary appliances, etc., were also given.²³⁴ Officers found qualified were reported to the Surgeon General's Office for assignment.

Early in August, 1917, the need of a sanitary laboratory for teaching and experimental purposes was clearly realized. Every known field sanitary appliance was constructed on a level area in the center of the camp.²³⁵ All officers were required to study these appliances and make drawings of the approved types, so that they would be thoroughly familiar with them when assigned to duty with troops.²³⁶ In addition to this, scientific experiments were carried out to determine the relative value of all such appliances. Interesting data were obtained and embodied in reports to the Surgeon General's Office. Every appliance which was built was constructed according to the plans given and, after construction, was given a thorough scientific trial under field conditions. In these experiments not only was the result obtained thoroughly analyzed, but every factor entering into the operation of the appliance was studied.

The fuel consumption of the different types of incinerators was studied with a view of determining which was the most economical under different conditions.²³⁶ Several new incinerators were invented and given practical trials. Among these was a multiple shelf incinerator which, on account of the great economy in fuel, was a great advance on the incinerators now in use. This incinerator was tested as to its capacity under varying conditions of temperature and wetness or dryness of the garbage.²³⁷ Careful experimentation was also conducted to determine what degree of heat could be developed with safety to the shelves and shelf supports. In April an exhaustive test of this incinerator was made. The entire daily output of garbage from Camp Funston (18,023 pounds) was completely incinerated with a total amount of 200 pounds of wood.²³⁸

Carefully drawn working plans were made of all appliances which were found satisfactory in any way and these plans were furnished the Surgeon General's Office.²³³ Models of all approved appliances were constructed and exhibited at the American Medical Association in Chicago in June, 1918.²²⁰ These models were afterwards sent to the Army Medical Museum, Washington.

Plates and descriptions of the sanitary appliances which were found to be most satisfactory were afterwards published by the War Department.²³⁸

During the winter of 1917-18 the severity of the weather prevented much outside work, so a complete workshop was fitted up indoors where experiments were made with models to determine whether modification of existing appliances would tend to greater efficiency or economy of time and material.²³⁷

Special instruction was given by this school to a large number of selected enlisted men.

The Sanitary School was closed July 1, 1918.²²⁰



FIG. 1.—This and Figure 2 show general views of the sanitary field appliances constructed at Medical Officers' Training Camp, Fort Riley, Kans.



FIG. 2



FIG. 2



FIG. 4



FIG. 5



FIG. 6

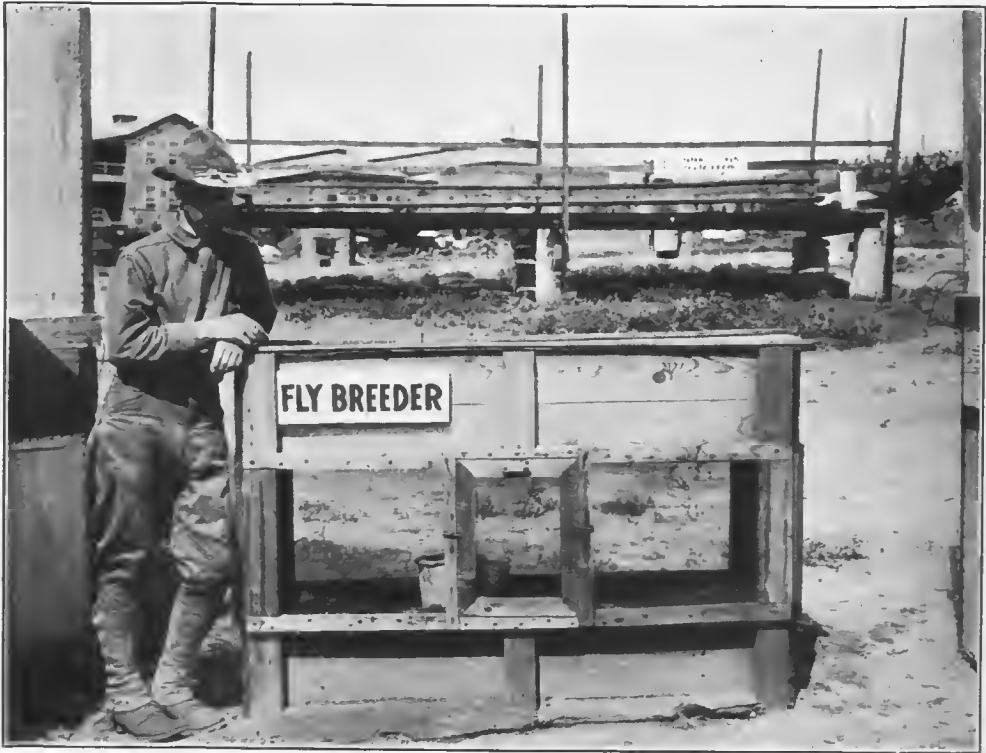


FIG. 7



FIG. 8.—Ober flytraps



FIG. 9



FIG. 10

By special arrangement with the authorities at Camp Funston, and under their supervision, the epidemiological work at that camp was handled by the School of Epidemiology, as there was a much larger field for instruction work at the larger camp.²⁰⁸



FIG. 11

The epidemic of meningitis at Camp Funston, which started on October 16, 1917, was handled and later controlled by this school, though they did not start on the work until November, 1917.²⁴⁰

An isolation camp was established at Camp Funston, and by special arrangement was put under the direction of this school, and one of the instructors was placed in charge of it.²³⁹ All contacts were sent to this camp and were carefully inspected twice daily by students of the School of Epidemiology. From 900 to 1,200 men were constantly interned in this camp.²³⁹



FIG. 12



FIG. 13.—Deep trench fly-proof latrine, cross section showing fly-proofing with oiled soaking urine deflectors. Fly-proof self-closing seats



FIG. 14



FIG. 15



FIG. 16



FIG. 17

SCHOOL FOR TUBERCULOSIS AND CARDIOVASCULAR EXAMINERS

In order to meet the need of trained men for cardiovascular and tuberculosis examinations, qualified instructors were sent to the training camp and officers with some experience in this work were given a thorough course of indefinite length along practical lines. When an officer was found qualified by the instructors he was reported by name to the Surgeon General and held for special detail from his office. If, after one or two weeks of instruction, an officer was found inapt in this particular line he was returned to the general course to be used otherwise.²¹⁰



FIG. 18

TUBERCULOSIS EXAMINERS

The following is a syllabus of instruction given tuberculosis examiners:²⁴¹

EXAMINATION OF LUNGS FOR TUBERCULOSIS

I. History:

- Family.
- Intercurrent disease.
- Repeated colds, pneumonia, pleurisy.
- Story of frequent pains in shoulder tips, abdomen, and backache.
- Social condition.

II. Present history:

- Cough.
- Night sweats.
- Chills and fever.
- Loss in weight.



FIG. 19



FIG. 20



FIG. 21

III. Inspection of chest:

Shape of chest.

Developmental defects of body.

Lung excursion; how to obtain, value.

Retractions; supraclavicular or apical; intercostal.

Heart, apex impulse, rate, relation to tuberculosis examination.

IV. Methods of percussion; direct; indirect; location; proper stroke; relation to respiration.

Tuning of individual chest and procedure of percussion.



FIG. 22

Land marks:

Liver dullness; mobility of lower border of lung.

Heart area.

Traube space, liver; spleen; stomach; heart.

Kernig isthmus.

Relation to lungs.

Difference in pitch over right and left apex normally.

Value of percussion in lung examination:

Cavities.

Areas of dullness.

Areas of higher pitched percussion note.



FIG. 23

V. Auscultation:

Methods of auscultation—

Proper stethoscope.

Position of the patient.

Explanation to the patient how to breathe during examination and when to cough.

Obstacles interfering with proper breathing.

Starting point for examination.

Breath tones:

Bronchial.

Bronchovesicular.



FIG. 24.—Drying platform for horse-manure, before incineration

Vesicular.

Amphoric.

Râles:

Subcrepitant.

Crepitant.

Large crepitant.

Mucus.

Fine shower of crepitant râles.

Constancy.

Diagnostic value of râles.

False râles:

Marginal, sternal, sterno-clavicular.

Muscular sound simulating râles.



FIG. 25

V. Auscultation—Continued.

Vocal resonance and fremitus:

Demonstration by bony contacts.

How produced.

Normal differences.

Value in diagnosis.

VI. Sputum examination:

How specimen should be obtained.

Findings.

Value of findings; positive; negative.

VII. X-ray examination:

Methods—

Single plate.

Stereoscopic.

Fluoroscopic.

What X ray will show—

Massive consolidations.

Calcified glands.

Shadows of the hilus or helix.

Radiations (thickening along bronchial trunks).

Cavities.

Acute inflammations; hazy outline of acute inflammatory processes as contrasted with sharper outline of older processes.

Chest deformity; drooping of ribs on side of old tuberculosis lesion.

Diagnostic value.

VIII. Résumé:

Pathology of lung tuberculosis; usual point of beginning of tuberculosis process and its dissemination.

Border-line cases.

Observation for a time may be necessary or advisable.

Degree of immunity to the tuberculosis process—differing in various patients and in the same patient at various times.

Tuberculin test.

Viewpoint of the Army surgeon or examiner—

1. Nonadvancing chronic tuberculous focus.

2. Advancing chronic tuberculous focus.

3. Deep active peribronchial focus.

4. Chronic healed peribronchial focus.

5. Tuberculous pneumonic process.

CARDIOVASCULAR EXAMINERS

The intensive course in physical diagnosis as applied to cardiovascular disease was conducted along the lines suggested in the following synopsis of lectures:²⁴²

LECTURE I

Diseases producing highest rates of mortality and discharge among soldiers; causes, prevention.

The heart: Heart sounds; effect of exercise; blood pressure; hypertrophy; dilatation. Effect on heart and body of strenuous campaign; proneness to infectious diseases and complications. Valvular disease: Variation from the older stated symptoms on young healthy soldiers; recognition; murmurs (using graphic charts of lesions from Greene's Medical Diagnosis); functional; systolic; diastolic; weight of rheumatic and infectious history. Valvular disease and its importance in recruiting service.

Examination of candidates: Methods; necessity of a personal stethoscope; scant pressure with bell; quiet room essential; couch; candidate stripped to waist, standing in front, general observation rapidly as to general condition, color, cyanosis, pulsation at cardiac region,

veins of neck; note hands as to venous stasis, clubbed fingers. Capillary pulse; count pulse; observe condition of arteries; quality and tension of pulse. Location of apex; proper method of percussion; outline outer border at fifth interspace and right border third interspace, right edge of sternum, noting, in centimeters, distance in or out from nipple line and right border of sternum. Auscultation: Heart sounds as observed (1) over apex; (2) third interspace, left sternum; (3) second interspace, right sternum; (4) lower left sternum; also transmission of sounds from these areas, then place in left lateral position and observe same; the difference from dorsal position; the accentuations and murmurs; count pulse in dorsal position. Exercise test: Hopping 100 times on one foot; count pulse immediately over apex with stethoscope; note accentuations and murmurs "1 to 4"; in two minutes recount pulse; then observe, in dorsal position, areas "1 to 4"; again in left lateral position. Systolic murmurs at apex are common (letter, Surgeon General, October 25, 1917 "Accept without hypertrophy"); the most difficult murmur to diagnose early and causing the greatest trouble in service; the mitral stenosis, early increase of dullness to right of sternum; accentuation of P_2 , becomes split sound after exercise; accentuation or drumming of systolic sound at apex; a presystolic thrill is found at times, a presystolic murmur; crescendo obliterating the sharp beginning of the systole, blending with the systole; then an early diminishing diastole, this increasing gradually, then comes fibrillation; subjective symptoms; resultant hypertrophy.

Aortic insufficiency next in importance, the only pure diastolic murmur that may be transmitted over the cardiac area heard best in the aortic area (3), transmitted to vessels of neck, difference in symptoms from young men and old hospital cases, blood pressure generally low in these cases. Corrigan pulse only marked with high blood pressure; capillary pulse evident; pistol shot femorals, resulting hypertrophy. Triuspid insufficiency not common, symptoms; systolic murmur at (3) right hypertrophy. Triuspid stenosis rare; symptoms, diastolic murmur, venous stasis. Pulmonary insufficiency and stenosis rare, usually congenital; murmurs transmitted to left shoulder hypertrophy. One or more valves may be involved at the same time; results. Questions.

LECTURE II

Compensation, fatigue, tachycardia; causes; types, hyperthyroidism, localities of exophthalmic goiter; tuberculosis; fevers. Arrhythmia, premature beats, sinus arrhythmia, fibrillation, rare in recruits. Bradycardia, block, arteriosclerosis, hypertension, aneurism and dilated arch.

Duties of examiner: To hold in service; to exclude the afflicted or undesirables; to determine fitness for special service of those otherwise to be rejected. Men desiring to serve will conceal lesions, men feign symptoms to obtain exemption; use drugs, as digitalis and glonoin, or chew cordite.

Examining boards, unless properly prepared, may overlook important cases; they are certain to turn up again, as a loss to the Government; the importance of previous history in questionable cases; nomenclature of disabilities (Manual of the Medical Department, 1916, p. 455) standard for acceptance, rejection, or discharge, waiver of disability for special service.

Report of examinations: Forward to Surgeon General, through division surgeon, report required. Lists form: (1) Name; (2) abnormal signs for which case was referred; (3) diagnosis; (4) recommendation, accept, reject, or waiver of disability for restricted service.

When organization examination completed; totaled officers and men; strength obtained from regimental adjutant; those examined; percentage constitutes regiment totals; the disposition percentage constitutes total examined; sheets signed. Entire camps totaled same manner, final totals summarizing work of examiner, sent to Surgeon General through camp surgeon. Special significant factors are entered under remarks; other examinations on special request of commanding officers. Special boards and their functions. Questions.

Clinical demonstration of method of cardiovascular examinations.

SCHOOL FOR LINE OF COMMUNICATIONS SERVICE^k

This school was organized in accordance with instructions from the Surgeon General. The first course commenced January 1, 1918. Officers who were especially assigned to this duty by the Surgeon General's Office, and all others who for various reasons were not considered suitable for first-line work, were required to take this course instead of the regular basic course of instruction. Six courses were given, extending to the last of June, 1918. The schedule prepared for this course was identical in character with that used for the basic course, with the difference that the hours given to certain subjects were fewer in number, and also some of the subjects treated in the longer course were omitted.

SCHOOL FOR ADJUTANTS

A special course for the instruction of officers for duty as adjutants of evacuation and base hospitals was begun November 20, 1917.²¹² Specially qualified men were selected and given thorough instruction in the details of an adjutant's work. They were then sent to the base hospital at Fort Riley to serve as assistants to the adjutant. After one month's duty in this capacity they were returned to camp and a special report on their efficiency was made by the hospital authorities. If found qualified they were assigned to such duty, but if not they were returned to a training company and assigned as considered best. This instruction was discontinued in the spring of 1918 on account of the detailing of Sanitary Corps officers to this duty.

GENERAL COURSE OF INSTRUCTION FOR ENLISTED MEN

The recruits arriving at camp were met at the train by officers and non-commissioned officers and brought immediately to camp.²⁴³ After they were checked at headquarters they were issued blankets and cots and divided into sections of from 48 to 68 men each, depending on whether they were to be quartered in pyramidal or hospital ward tents (for some months all recruits received at camp were quartered in tents). They were then instructed in several of the most important Articles of War.

They were next carded.²⁴³ Each card showed the man's name, age, occupation, how long employed, pay received, education, and previous service, if any. The section number was entered on each card. These cards were then checked against the list at headquarters. The cards were then examined carefully and from them a list of men who appeared to be good material for noncommissioned officers was made. In such selection preference was shown to those who had received at least one year in college work, who had been foremen or who had occupied positions in civil life which entailed responsibility. The men selected were then given a personal examination and finally those considered favorable material were detailed as lance corporals in the proportion of 1 lance corporal to each 8 privates. If the number of men who were well educated and well qualified was great, the proportion was increased. This rapid selection of lance corporals of course eliminated from consideration for the time being a large number of steady, worthy, reliable men who, in time, would make excellent non-

^k For substance of instructions, see Camp Greenleaf School for Line of Communications Service, p. 78.

commissioned officers, but a standard for rapid selection had to be formulated, and if those selected did not make good, they were reduced and others who were showing rapid advance in discipline, leadership, etc., were detailed in their places.

All sections were sent out to drill at 7.30 a. m., and were drilled from that time to 9.30 a. m. by a detail of medical officers selected from those in the training companies who had shown most ability in the work.²⁴³ For the first half hour they received physical instruction from Koehler's Manual and for the remaining time squad drill, school of the soldier, and school of the squad. The rule laid down was 10 minutes drill followed by 5 minutes rest. During the drill period the work of the officers was supervised by an assistant instructor who checked carefully the character of the drill given by the various instructors and made notes of officers who were satisfactory or unsatisfactory. Those found unsatisfactory were immediately relieved and others detailed in their places. The number that had to be relieved was fortunately very small. In addition to the assistant instructor, four inspectors were detailed from the best qualified officers and these assisted the instructors in the minor points and technicalities of the work. From 9.30 to 10 a. m. the recruits were drilled as sections by their section leaders, and from 10 to 10.30 a. m. there was customarily a competitive drill by sections.

Throughout this instruction in foot drill the aim was to inculcate alertness, soldierly bearing, and prompt response to the word of command.²⁴³ Great stress was laid upon the point that all movements must be carried out strictly in accordance with cadence. It was intended that this drill should serve fully as much to inculcate obedience and respect to superiors as it did to teach smartness in formation.

At 10.30 a. m. a medical officer lectured to the lance corporals on anatomy, physiology, or some allied subject.²⁴³ This lecture was short, and at 11.15 the corporals returned to their squads and imparted to them the instruction just received. This increased the standing of the lance corporal with his squad by stamping him as a man who knew a little more than his comrades and made the enforcement of obedience to his commands somewhat easier. It was recognized that the instruction that these lance corporals gave might be in some particulars incorrect. Experience showed, however, that the practical knowledge the men got of the elements of anatomy and physiology was very real and served as a useful foundation for the more detailed instruction which they received upon being assigned to permanent organizations.

At 1.30 p. m. the lance corporals received a lecture on the customs of the service, the salute, how to recognize an officer, the proper respect enlisted must show to officers and noncommissioned officers, their duties, and their privileges.²⁴³ This instruction they likewise transmitted to their squads. At 3.30 p. m. the lance corporals received instruction in giving commands at drill, etc.

This instruction was varied and advanced after two weeks by the substitution of first-aid instruction in the morning period and in the afternoon first aid and the care of animals were taken up at 1 p. m. in the lecture periods.²⁴³

The following is the list of calls prescribed:²⁴³

5.30 a. m.-----	Reveille.
5.50 a. m.-----	Mess.
6.20 a. m.-----	Sick call.
6.30 to 7.25 a. m.-----	Stables—police of camp.
7.30 to 8.25 a. m.-----	Drill.
8.30 to 9.25 a. m.-----	Drill.
9.30 to 10.30 a. m.-----	Drill.
10.30 to 11.30 a. m.-----	Lecture and quiz (first two weeks). First aid (second two weeks).
11.30 to 1.20 p. m.-----	Dinner.
1.20 to 2.45 p. m.-----	First aid.
2.50 to 3.40 p. m.-----	Care of horses and corrals for student officers (before daily equitation).
3.45 to 4.50 p. m.-----	Rest period.
4.50 to 5.30 p. m.-----	Stables.
5.45 p. m.-----	Retreat.
5.50 p. m.-----	Supper.

Physical instruction of the recruit was begun shortly after his arrival in camp and was carried out in a most thorough manner.²⁰⁸ An officer who was an expert physical instructor was detailed in charge of this work. A well-laid-out athletic field was provided, and each organization in camp spent at least two hours a week on this field in addition to the special exercises prescribed in their section and company drills.²⁴⁴ During the winter months a large barrack building was converted into a gymnasium, and special gymnastic instruction was conducted there throughout the winter.

In the gymnasium the work consisted of playing handball and basket ball, bag punching, boxing, calisthenics, apparatus and bar work, and resistance exercises. Special instruction in boxing was given to a number of men from the companies who had received previous training.²⁴⁵ This was given by an expert boxing instructor.²⁴⁶ As soon as they were found qualified they were required to instruct their companies during the physical instruction period. On the athletic field the exercises consisted of athletic games, running, jumping, wall scaling, bank climbing, hand grenade throwing, etc.²⁴⁶

To facilitate control, the sections were combined into groups of from 150 to 500 men each. Each morning at mess call the sections were marched to the mess halls.²⁴³ After breakfast the sick were taken to the infirmary by a lance corporal, with their names entered upon a separate sick book for each section. The sick of the various sections were further supervised by a noncommissioned officer from each group. After the sick had left for sick call and during the interval between breakfast and the first drill hour each section was carefully examined by a medical officer for the detection of any infectious diseases. During the day section leaders were required to send to the infirmary every man who stated that he was unable to drill or who appeared ill.

Fatigue was furnished by sections; that is to say, if the casual detachment was called on for 30 men for fatigue the section designated would furnish the entire number and would send them out in charge of their own lance corporals.²⁴³

Section leaders were constantly on the alert for good substantial men in their sections. These men, when recommended by the section leaders, were

assigned as assistant section leaders to some other section where the men did not know them and where they were given the opportunity to make good. If they made a favorable impression, they were given a section of their own and a further tryout. If one of these men did not make good, he was put back into the ranks of a section, care being taken to place him in neither the one he originally came from nor the one in which he served as section leader.²⁴³

The time spent in the recruit sections varied according to the demand for men and the stock on hand. It was desired, in so far as was possible, to hold a substantial number of recruits in training in the casual detachment. An arbitrary limit of 10 days was taken as the briefest time prescribed that a man should remain under observation in the detachment before being assigned to a company. No man was assigned out of the detachment who was a mental defective, insane, had criminal tendencies, or who would later become a subject for disability discharge.²⁴³

When a call came for recruits to be assigned to some organization, they were selected carefully according to their progress in general soldierly deportment and according to the special duty they would have to perform.²⁴³ The section was formed, each man's name was called from his card, and when he stepped forward a rapid survey was made of him as to his carriage, general appearance, physique, and alertness. If his previous occupation suited the particular assignment, his card was laid aside; but if neither the man nor his occupation came up to what was required, his card was placed again in the files. For example: If men were being selected for a motorized ambulance company, men were selected who had had previous training as chaffeurs, machinists, etc. If the call was for animal-drawn company, the farmer class was selected. In both instances men of robust physique were only considered. If the call was for a base hospital, a search was made for chemists, clerks, hospital orderlies, etc. After the cards were selected in this manner they were rechecked and examined to be sure that the number of lance corporals corresponding to the noncommissioned officers to which the organization was entitled were assigned, and also that the unit was furnished with an artificer and, in case of an animal-drawn company, with a blacksmith and, if possible, a farrier, should these men be available. The cards were then gone over to see if any man had a brother or cousin in the detachment, as a great effort was made to keep relatives together wherever that could be done without injury to the service.

After an organization had been formed, particularly if the period of observation had been brief, if it was found that a few unfit men had been assigned, these men were returned to the casual detachment for further study.²⁴³ Many times these men, after a stay of from a month to six weeks longer in the casual detachment, were sent out again to other companies, where they made good.

From 75 to 100 men who were selected from those who had previously received training in the handling of animals were placed together in two sections.²⁴³ These sections did little drilling and no fatigue. They took care of the quartermaster stables and the horses used by the student officers. In this detachment if a man was not satisfactory he was immediately transferred out and replaced by another. From these selections detachments for service with Cavalry regiments were formed, and they also furnished the mounted orderlies

required with every regimental detachment. Owing to the impossibility of adequately training more than 100 men at a time, the number of mounted orderlies supplied did not exceed 2 to each detachment.

There were constantly about 25 to 30 men in the detachment who could not speak, read, or write English. An effort was made to have these transferred to the line, but this was disapproved, and a separate section to provide for their proper instruction in English was formed.²⁴³ The section leader had been a college professor and all of the lance corporals had been school-teachers. Books on elementary English were bought by the camp exchange and sold to each man in the section. Instruction in English was given intensively and the men were excused from all other duties except drill.

Every department in camp was encouraged to use as many men as possible in clerical work in order to train a large number of men in Army paper work. When clerks were required in a company or detachment being formed, they were taken from the best qualified among these men.²⁴³

An observation section was established for the study of the insubordinates, the training of the awkward and unfit, and the teaching of discipline to the unruly.²⁴³ All individuals who were hard to handle, habitually committed minor offenses, or set bad examples in lack of discipline and soldierly qualities were removed from the regular recruit sections and assigned to the observation section. The men were selected for this section in two ways:²⁴³ First, the assistant instructors, at drill, observed all recruits closely and recommended for transfer to the section those men who were awkward, and especially those who showed retarded mental development. These cases were selected especially during physical drill, as that drill required an average standard of coordination. Second, the section leaders observed their men in the intervals between drills and recommended for transfer the insubordinate, surly, quarrelsome, and excessively profane men in their sections.

The section was in charge of a sergeant, first class, of long service, especially selected on account of his proficiency in handling and controlling men.²⁴³ Assigned to him as assistants were noncommissioned officers who had shown exceptional ability in the handling of recruits, who were quiet and self-reliant, and above all highly intelligent. These were all under the command of a carefully selected officer. This officer observed the progress of each individual day by day and examined them personally at frequent intervals and made a careful estimate of their mentality. If this officer considered a man mentally defective in any way, he was carefully examined by a psychiatrist, who recommended his disposition.

During their stay in this section the men received every day three hours of foot drill, one hour's physical drill, and lectures on anatomy and physiology.²⁴³ Company punishment in the nature of extra fatigue for those who needed it was carried out more rigidly and with better observation than was possible in the average company. It was rarely found necessary to try any of these men by court-martial.

After a man had demonstrated that he had overcome his awkwardness and had learned his drill or that he had learned military discipline and would not again be guilty of insubordination, he was transferred to one of the regular

sections.²⁴³ The more difficult cases were always under careful observation, particularly in reference to their mental condition. There were instances where men became good soldiers after a period of from one to two months in this section, and some apparently hopeless individuals made excellent progress.

The number constantly under observation averaged 60. It occasionally went up to 80 and sometimes fell as low as 40. The number of men going in and coming out remained fairly constant. Many men who ordinarily might have remained in a company for a year or more, giving constant trouble, were found to be insane or mentally defective.²⁴³

As an indication of the time required to bring the men up to standard the following is a table prepared for the three-month period ending September 1, 1917:²⁴³

Transferred after a period of—

One week.....	11
Two weeks.....	12
Three weeks.....	29
Four weeks.....	21
Five weeks.....	9
Six weeks.....	2
Seven weeks.....	4
Eight weeks.....	3
Nine weeks.....	2
Two have remained for more than 10 weeks.	

From this table it can be seen that the average stay was less than three weeks.

The advantages of the system were as follows: ²⁴³ (1) It provided facility for the careful study of border-line insanity cases: (2) It eliminated from the other units of the command the men who habitually committed military offenses and acted as a detriment to the instruction of the average recruit. (3) It acted as a support and relief to the untrained noncommissioned officer. (4) It afforded an opportunity for the training of men who had not had the advantages of education or who, for various reasons, were backward in their development, and saved for the service an appreciable number of men who otherwise would have been worthless.

After the men were assigned to ambulance companies, field hospital companies or other units, the primary instruction in the school of the soldier was continued until each individual was trained to such a degree that he could proceed with the more specialized instruction. This instruction will be outlined under the heading of "Special instruction for enlisted men" (p. 244).

This system of handling recruits was not changed materially when inductants from the draft were received at camp.²⁴⁶ In the latter case their physical examination preceded everything else, and no mental examination or carding of individuals was started until they had been definitely accepted into the service. The physical examination methods were similar to those used in the larger camps.

SPECIAL INSTRUCTION OF ENLISTED MEN

As it was necessary to train a large number of enlisted men of the Medical Department to be specialists, courses for the training for these men were started very early in the history of the camp and every effort was made to include in each unit formed at the camp its proper quota of well-trained specialists.

COOKS

Men who stated that their occupation was cooking, or who had previously received training in cooking, or who desired to learn to be cooks, were assigned to a school for cooks and bakers conducted in conjunction with the general messes of the camp.²⁴³ After a thorough course, those qualified as cooks were assigned to all units organized at this camp. In the early part of 1918 a complete bakery was established at the camp, and each student in this school was given a definite period of training in baking.

WARD ATTENDANTS

A course of training for ward attendants was given to all male nurses and also to a large number of other men who were well qualified for this work. By a special arrangement with the commanding officer of the base hospital, Fort Riley, these men were placed on duty in the wards of the hospital and acted as assistants to the ward masters.²⁴³ In addition to their work at the hospital they received one hour's lecture daily. The course was continued for four weeks and on its completion men who were found qualified were assigned to evacuation and base hospitals with a recommendation for the rating of ward attendant. The following is a syllabus of the instruction received in this course:²⁴³

NURSES

Assigned to wards at post hospital. Lecture at camp one hour daily.

First week:

- Admission of patient.
- Care of patient's personal property, money, and clothing.
- Sweeping and cleaning ward without raising dust.
- Temperature, pulse, respiration.
- Baths.

Second week:

- Review, especially in temperature, pulse, and respiration.
- Bed making, simple, surgical, fracture.
- Changing linen on occupied bed.
- Enemata.
- Continuous drips—soaks.

Third week:

- Lifting and handling patients.
- Fowler's position, Murphy drip.
- Use of catheter.
- Hypodermic.
- Signs of collapse, impending death, death.

Fourth week:

- Care of property—property check, drawing property, exchange of property.
- Linen—care, exchange, credit slips.
- Ward morning reports. Report of death. Chart.

SURGICAL ASSISTANTS

The same arrangement was made with the commanding officer of the base hospital, Fort Riley, for the instruction of ward attendants.²⁴³

First week: The course consisted for the first week of lectures and recitations on bacteria, pyogenic bacteria, wounds (clean and infected), asepsis, antiseptics, sterilizing, chemical antiseptics, bandaging.

After the first week they were assigned to duty in the various operating rooms of the base hospital, but were also given instruction, mostly practical.

Second week:

Preparation of aseptic dressings—sponges, wipers, pads, strip drains of all kinds, threaded needles.

Preparation of T bandages, swathes, laparotomy sheets, splints.

Care of instruments and rubber goods.

Third week:

Sterilizing, practical; reasons for different methods.

Sharpening knives and other instruments.

Fourth week:

Preparation of patient for different operations.

Care of anesthetized patient on table.

Lifting patient from table.

Arranging anesthetist's table.

Laying out instruments.

Opening sterile packages.

Throughout the course students were given opportunity to watch actual operations when practicable.

DISPENSARY ASSISTANTS

A limited number of men were given training for work as dispensary assistants, but men selected for this training were taken from those who had previous knowledge, for it was well understood that a short course could not prepare even a very intelligent man to carry out the duties of the position unless he had had previous experience.²⁴³ The course was so arranged that students were on duty at the post hospital dispensary during the morning, and had lectures and recitations on pharmacy and materia medica during the afternoon. Candidates were required to have absolute familiarity with doses of drugs and their antidotes. Morning instruction was by practical demonstration and actual work done by candidates.

First week: Compounding and dispensing simple formulæ.

Second week: Preparation of ointments and percentage formulæ.

Third week: Infusions and tinctures.

Fourth week: Suspensions; incompatibility.

SANITARY SQUADS

Men assigned to the sanitary squads organized at the camp were attached to the sanitary laboratory.²⁴⁷ They were given extensive instruction in the practical application and construction of the various forms of apparatus provided there. They were also required to conduct the fly-prevention campaign during the spring of 1918. This campaign resulted in an almost complete absence of flies during the following summer.

X-RAY TECHNICIANS

The course for X-ray technicians was conducted in conjunction with the School of Military Roentgenology and provided instruction for a limited number of specially qualified enlisted men, most of whom were from the evacuation hospitals.²⁴⁸ The course covered the following subjects: Dark-room technique; physics of the X ray; handling of apparatus, and a limited amount of anatomy. A small manual for the instruction of enlisted technicians was prepared by the instructors in this school and was printed and distributed to the students.²⁴⁹ A complete portable field X-ray outfit was provided for the practical instruction of the class.

ORTHOPEDIC ASSISTANTS

A short course to prepare enlisted men as orthopedic assistants was conducted during the winter and spring of 1918.²⁴³ This instruction was given to provide each regimental detachment with a man having practical knowledge of the common ailments of the foot and sufficient ability to treat corns, etc., and to fit shoes properly to somewhat deformed feet. The following is an outline of the course taught:²⁴³

Lecture 1 (one hour): The human foot—Its anatomy, physiology, examination, and the significance of its abnormalities; symptoms and signs; limitations of flexion; abduction and pronation; eversion, inversion, low arches; flat feet; prominent scaphoid arthritis.

Quiz and recitation, Munson.

Lecture 2 (one hour): The soldier's foot and the military shoe.

Lecture 3 (one hour): The disabilities of the soldier's foot and their treatment. Acute foot strain; treatment; purpose, application; further treatment; ordinary foot strain; flaccid feet; rigid feet; spastic feet; flat feet; treatment; osseous flat feet; affections of the anterior arch; calluses on sole over the metatarsal heads; metatarsalgia, treatment; affections of the regions of the heel involving the tendo Achillis; involving the os calcis, treatment; hallux rigidus, hammertoe, treatment; deformities of little toe.

Quiz and recitation from Munson (one hour).

Clinic (one hour).

Shoe fitting (one hour).

Shoe alterations (one hour).

Special instructions in basic orthopedics was also given to 4 per cent of the enlisted men of the entire command.²⁴³

AMBULANCE COMPANIES AND FIELD HOSPITAL COMPANIES

When ambulance and field hospital companies were organized men were assigned to them from the casual detachment, and their training then came under the supervision of the officers in charge of these sections.²⁵⁰ The training was continued along the general lines laid down for the casual detachment, and as rapidly as possible they were given special training to fit them for the duties they would be called upon to perform.

The instruction in the ambulance companies was carried out according to the following memorandum:²⁵⁰

INSTRUCTION MEMORANDUM

First week:

- 7 to 9.20 a. m.----- Drill, foot, 1 hour; litter, 1 hour.
- 9.30 to 10.20 a. m.--- Motor companies only, mechanism of automobile.
- 10.30 to 11.30 a. m.--- Anatomy and physiology (Mason, pp. 37-38).
- 1.30 to 2.20 p. m.---- First aid (Mason, pp. 89-107).
- 2.30 to 3.20 p. m.---- Messages, signals, general orders, etc.
- 3.30 to 4.20 p. m.---- Nursing (Mason, pp. 169-178 and 185-199).

Second week:

- 7 to 9.20 a. m.----- Drill, litter, 1 hour; ambulance, 1 hour.
- 9.30 to 10.20 a. m.--- Motor companies only, mechanism of automobile.
- 10.30 to 11.30 a. m.--- Bandaging.
- 1.30 to 2.20 p. m.---- First aid, (Mason, pp. 108-140).
- 2.30 to 3.20 p. m.---- Messages, signals, general orders, etc.
- 3.30 to 4.20 p. m.---- Nursing (continued as in program of first week).

Third week:

- 7 to 9.20 a. m.----- Drills, tent. During the ensuing weeks in such exercises as the commanding officer may deem necessary to promote the efficiency of his company.
- 9.30 to 10.20 a. m.--- Motor companies only, mechanism of automobile.
- 10.30 to 11.30 a. m.--- Bandaging.
- 1.30 to 2.30 p. m.---- Entire week—review work of previous two weeks from Mason.
- 2.30 to 3.20 p. m.---- Classes for specially selected privates.
- 3.30 to 4.20 p. m.---- Entire week—review work of previous two weeks from Mason.

Fourth week:

- 7 to 9.20 a. m.----- Drill as prescribed by the commanding officer.
- 9.30 to 11.30 a. m.--- Classes for specialists.
- 1.20 to 4.30 p. m.---- Instruction of company as a unit.

The instruction of the field hospital companies was similar to that carried out by the ambulance companies.²⁵⁰

NONCOMMISSIONED OFFICERS' SCHOOL

A special school for the training of noncommissioned officers was organized in a small way from the establishment of the camp, and all lance corporals who showed adaptability for this promotion were given instruction in this school in addition to their other duties.²⁴³ Whenever men detailed to this work showed that they were not suited they were immediately relieved and returned to the ranks of the detachment. The full course consisted of six weeks' instruction.

First week:

- Morning—Cooking and mess management, in camp and field; setting up field range; daily menus.
- Afternoon—Arithmetic; hospital fund papers; daily report of mess.

Second week:

- Morning—Care of medical, ordnance, and quartermaster property; property books or cards; checking property; names of medical appliances and their component parts.
- Afternoon—Medical, ordnance, and quartermaster property papers. (Returns, requisitions, invoices, receipts.)

Third week:

- Detachment papers.
- Army Regulations.

Fourth week:

- Morning—Sick and wounded.
- Afternoon—Materia medica and pharmacy

Fifth week: Minor surgery and first aid.

Sixth week:

- Elementary hygiene.
- Review.

VETERINARY SECTION

A special section for the training of Veterinary Corps enlisted men was started February 25, 1918.²⁵¹ At first the training consisted mostly of drills and marching to get the men in proper physical condition. As soon as they received their equipment the men were assigned to recruit squads until proficient, when they were put into the regular squads for further instruction. Lectures on hygiene and military discipline, including honors and ceremonies, were given recruits as soon after joining as possible. All men were given one week's work and instruction at the corrals, where they were taught the use and care of Cavalry horse equipment and stable management, including grooming, feeding, tying in, care of feet, and care of stalls.

Men with some previous experience were also assigned to the School of Hippology, Fort Riley, for a three weeks' course.²⁵¹ Later, when there were no men with some training in this work, green men were assigned to the school for instruction, but the time required to make them qualified horseshoers had to be extended to two months.²⁵² Difficulty was experienced in obtaining pistols with which to equip these men, and finally pistols were borrowed from the ambulance companies so as to give a certain amount of target practice to all enlisted men before they were ordered from the camp.²⁵²

In May a noncommissioned officers' school was started with 18 selected men under instruction.²⁵³

The training work in the veterinary section practically ceased in September, 1918, on account of shortage of veterinary recruits.²⁵⁴

Copies of schedules followed in the instruction of these men are given below:²⁵¹

Schedule of instruction for week March 24 to 30, 1918

7.30 to 8.15 a. m.	Calisthenics; everybody except stable detail.
8.20 to 10.30 a. m.	Equitation; second squad second week.
8.20 to 10.30 a. m.	Equitation (Monday, Tuesday); tent pitching (Wednesday, Thursday, Friday); squad who completes 20 hours' equitation.
8.20 to 10.30 a. m.	Foot drill; old stable squad, recruit squad.
10.30 to 11.30 a. m.	First aid; second equitation squad, first equitation squad, old stable squad, recruit squad.
1.30 to 2.45 p. m.	Gas drill (Monday, Tuesday, Wednesday, Thursday, Friday); all men in first-aid drill and every other man available.
2.45 to 3.45 p. m.	Gas lecture (Thursday and Friday only).
2.55 to 4 p. m.	Foot drill; first equitation squad, stable squad, recruit squad.
2.55 to 4 p. m.	Stable sergeant's manual (lectures and recitations); second week for second equitation squad.
2.50 to 4 p. m.	Veterinary regulations and requisitions; selected men.
8 a. m.	Inspection (Saturday).
9.30 to 10.30 a. m.	Gas exposure (Saturday); gas house.
8.20 to 10.30 a. m.	New recruits and awkward squad, foot drill.
10.30 to 11.30 a. m.	Hygiene, Articles of War, military courtesy, and salute.
1.30 to 2.15 p. m.	Calisthenics.
2.20 to 4 p. m.	Drill.
4 to 4.50 p. m.	Hike; for entire command.
7.30 a. m. to 4.25 p. m.	Stable detail; 20 men.

Schedule of special classes, May 26 to June 1, 1918

7.30 a. m. to 4.30 p. m.----	Horseshoers' school; M. S. S.; 43 new men, 14 old men.
7.30 a. m. to 4.30 p. m.----	For police and guard duty at medical officers' training school corrals; 1 sergeant, 2 corporals, 4 farriers, 66 privates, daily.
7.30 a. m. to 4.30 p. m.----	Manual of small arms; pistol target practice; all available men.
7.30 a. m. to 4.30 p. m.----	Noncommissioned officers' school; 18 specially selected men. Instruction in special foot drill, training and commanding, paper work in connection with office.

FORT RILEY, KANS.(July 1, 1918, to February 4, 1919)¹

The partial merger of the Medical Officers' Training Camp at Fort Riley with that at Fort Oglethorpe, Ga. (see p. 25), was made during the month of July, 1918.²²⁰ With the change there was a sharp curtailment in the scope of training prescribed for the Fort Riley camp.

The decision regarding the Reserve Corps instructors to be left at Fort Riley was based on the needs connected with the training of regimental detachments, ambulance companies, and field hospitals. This limitation in the extent of training was a material change from that previously effected by the camp. The new work was to be confined to the training of officers and enlisted men for service with front-line units, leaving for Camp Greenleaf the far more pretentious training for special services connected with units of the line of communications and base. The transfer of trained instructors removed from Fort Riley the majority of the Regular officers and a large number of Reserve Corps officers who had been developed into trained teachers along special lines. Certain excess property, including saddle horses and riding equipment, was sent to Camp Greenleaf, where it was greatly needed. The movement was almost entirely effected during July. There were left at Fort Riley five Regular medical officers. About 20 Reserve Corps officers remained who, by virtue of their prior service at the old camp as instructors or assistant instructors, could be utilized as instructors for the new camp.

One of the first important changes made in camp administration immediately after the establishment of the new camp was the creation of the office of camp personnel adjutant, as directed by Special Regulations 57 and 57A. Because of the necessity of the work of this office being closely associated with headquarters, it was decided to move camp headquarters into one of the large barracks formerly occupied by one of the student companies. This building gave room not only for headquarters but for the desks, files, and personnel of the office of the camp personnel adjutant. The office of the officer in charge of the casual detachment was also moved from its former location in the camp to an adjoining building. These measures added to camp efficiency by having all administrative officers, including the quartermaster and mess officer, located close to headquarters.

New medical officers for the course of instruction began to arrive during the transformation of the camp. They were assigned to barracks in company

¹ Unless otherwise indicated, the statements herein are based on History of Medical Officers' Training Camp, Fort Riley, Kans., from July 1, 1918, to its close, Feb. 4, 1919, by Lieut. Col. H. F. Pipes, M. C., Sept. 9, 1921. On file, Record Room, S. G. O., 3516 (M. O. T. C., Fort Riley, Kans.).

organizations. The size of each company was not fixed numerically, being determined by the capacity of each building. From July 15 until the signing of the armistice 1,620 reported for training, and from the time of the organization of the camp until its close more than 4,500 officers and 25,470 enlisted men reported for training. Student Companies Nos. 36 to 54, inclusive, were created; 54 student companies in all were organized at Fort Riley.

Officers who, in the opinion of the camp surgeon, were not physically fit for field service were acted upon by a board of medical officers, which rendered its report and recommendation as to whether or not the officer should be continued in the service. These reports were forwarded to the War Department. Some of these officers reported as physically unfit for field service were assigned to stations in the United States and some were discharged from the service.

One of the important functions of the camp was the organization of units for overseas service. Orders were received for the organization of hospital trains, replacement units, evacuation ambulance companies, one corps sanitary train, and one Army sanitary train. Hospital Trains Nos. 38 and 39 were organized at the camp. Replacement Units Nos. 60 and 61, under orders dated August 9 and August 15, respectively, consisting of 250 men and 1 medical officer each, were reported ready for overseas service on August 16, 1918, and left Fort Riley, Kans., for Camp Merritt, N. J., August 24, 1918. Replacement Units Nos. 47 to 53, inclusive, consisting of 250 men each, were ordered to be organized by instructions, dated August 19, 1918, which were subsequently rescinded under instructions of September 7, 1918. Evacuation Ambulance Companies Nos. 21 to 49, inclusive, consisting of 1 officer and 37 enlisted men were ordered to be organized under instructions of September 7, 1918. Evacuation Ambulance Companies Nos. 27 and 28 and 36 to 41, inclusive, were reported ready for overseas service on October 22; and Evacuation Ambulance Companies Nos. 42 to 45, inclusive, were reported as ready under date of November 7. Evacuation Ambulance Companies 82 to 101, inclusive, were ordered organized under telegraphic instructions from the Surgeon General dated October 7, 1918, but these instructions were modified later by the Surgeon General under date of November 13 to the effect that they would not be sent overseas. Replacement Units Nos. 74 to 77, inclusive, consisting of 275 enlisted men and 2 officers each, were ordered to be organized under date of September 20, 1918, which was rescinded by telegram from the Surgeon General on October 19. Corps Sanitary Train No. 1 and Army Sanitary Train No. 1 were reported ready for overseas service on November 7, 1918. On November 21, 1918, instructions were received canceling all shipments of troops because of the signing of the armistice.

The organization of these overseas units was placed in the hands of the officer in charge of the casual detachment and the commanding officer of the sanitary train. As far as possible men were assigned to the units in accordance with their vocational qualifications, as prescribed by tables of organization. In several instances it was impossible to find men trained along specific lines to make a unit complete. This was due primarily to the shortage of enlisted men that developed in the camp.

Troop shipments and all the details relative thereto were performed by an entraining officer. Immediately upon receipt of orders from The Adjutant General directing a troop shipment, the entraining officer would be notified by headquarters. He immediately interviewed a railroad administration representative at Camp Funston, and arrangements were made for placing the necessary number of coaches and baggage cars on the medical officers' training camp siding of the Union Pacific Railroad.

The camp quartermaster was a member of the Quartermaster Corps in the first Fort Riley camp. He was succeeded by a medical officer, detailed as camp quartermaster. The medical officers' training camp was under the commanding officer at Fort Riley for purposes of administration and supply only. The source of supply of all Quartermaster Corps articles was, therefore, Fort Riley. The Medical Department property was obtained from the medical supply depot at Camp Funston. Rations were procured from the quartermaster at Fort Riley or purchased in open market. Articles of uniform and camp equipment issued to the enlisted men were obtained by the camp quartermaster from Fort Riley, and in turn reissued by him to the several organizations in the camp. This service was satisfactory. The training camp maintained a motor-repair shop which rendered the necessary service for ordinary motor repairs required in the camp. Toward the close of the camp orders were received transferring all motor vehicles to the Motor Transport Corps.

The messing of the student officers and the enlisted men in the camp was under the control of the camp mess officer. Formerly this work was done by a captain of the Quartermaster Corps, and upon his transfer to Camp Greenleaf, his responsible duties devolved upon a lieutenant in the Medical Corps who had previously seen very little service along that line. This officer assumed the duties of camp mess officer in an admirable fashion and rendered very efficient service. He was responsible for the student officers' messes and the messes maintained for the majority of the enlisted men. One, two, or three messes were maintained for the student officers according to the number present. Officers were charged a dollar a day for their food. The mess was satisfactory, but it required untiring vigilance to prevent complaints. Civilian cooks and waiters were employed in these messes. A large general mess was maintained for the enlisted men, located in the vacated artillery gun sheds at Fort Riley. Several messes were conducted in various locations throughout the camp for the enlisted men of the casual detachment. Other independent messes were maintained for such permanent camp organizations as the field hospital and ambulance companies.

The Medical Department service in the camp was efficiently handled by a medical officer designated as camp surgeon, assisted by a variable number of medical officers, determined by the amount of current work. The base hospital at Fort Riley was considered as the hospital for sick of the command. All medical detachment reports relative to the sick and wounded were rendered by the base hospital. The surgeon of the camp did not supervise the sanitation of the camp, which was placed in the hands of an officer designated as camp sanitary inspector. The camp surgeon held daily sick call and made all reports on the physical examination of officers and enlisted men. All venereal cases

were handled in the camp, except cases of syphilis requiring the administration of salvarsan, which was given at the base hospital. The health of the command was very good. During the influenza epidemic of October, 1918, an extemporized camp hospital was organized for the receipt of all influenza patients. From this camp hospital cases were promptly transferred to the base hospital when they presented severe symptoms. No Medical Department records were kept in the camp of cases requiring slight treatment. There was a small camp hospital, regularly established in connection with the camp infirmary, to which one or more medical officers were assigned for the purpose of treating minor cases of the sick of the command. No permanent Medical Department records were kept of this group of cases.

The camp exchange was centrally located in the training camp, but during the periods when the enlisted strength of the command varied between three and four thousand men one small subsidiary exchange was established. During the summer of 1918 the receipts of the exchange were heavy. A small improvised bakery was established, first by the mess officer, but subsequently it was taken over by the camp exchange in order to avoid the accumulation of unauthorized funds in the hands of that officer. Cakes, pies, and pastry, together with ice cream, were made by the bakery and considerable profit accrued from its operation. The exchange fulfilled a useful need in the camp, particularly in meeting the requirements of the enlisted men. Sales were much cheaper than those prevailing in the adjoining towns of Manhattan and Junction City, and yet the margin of profit was such as to permit of liberal dividends to those organizations participating in it. Upon the closure of the camp in February, 1919, the camp exchange officer, in pursuance of general instruction from The Adjutant General, transmitted to the War Department over \$40,000, which was obtained from cash on hand and money accruing from the sale of stock and fixtures.

The quarters occupied by officers and enlisted men were wooden cantonment buildings of the one-story type, of a capacity varying from 80 to 100 men. They were heated by coal stoves, from two to four stoves in each building. On account of the wooden construction of these barracks, although lined with beaver board, during the severe winters of 1917-18 and 1918-19 there was some discomfort from the cold. Lavatories were in the rear and detached from each barrack, one, as a rule, being provided for each building. There were not adequate quarters for the enlisted men at the medical officers' training camp at Fort Riley until the latter part of the summer of 1918, when the alteration and remodeling of 18 Cavalry stables had been completed in the casual area of the training camp. Lumber and other material were available for these alterations, and the labor was supplied by the enlisted men of the camp. From the Cavalry stable sheds fairly comfortable barracks were obtained by walling and flooring them. Adequate doors and windows were provided, together with stoves and iron bunks. Thus modified, the barracks were capable of holding from 80 to 120 enlisted men each, allowing each man the proper amount of floor space. In these areas there was some discomfort on account of the lack of lavatories. In some cases it was necessary to establish pit latrines, and constant vigilance was required to keep them in proper condition. It was

planned to construct camp lavatories connected with the water system of the camp in the area of these modified barracks, but this was not done because of the cessation of camp activities shortly after the signing of the armistice. During the fall of 1918, realizing that a large lecture hall must be provided for the officers' school during the winter, an auditorium with a seating capacity of 800 was erected by the enlisted men of the command. It met a great need of the camp, was centrally located, and was used as a lecture hall and a place for theatrical amusements for the benefit of the entire command.

GENERAL INSTRUCTION FOR OFFICERS

In the old order of things among the medical officers' training camps it had been ascertained that no more than 40 per cent of the Medical Reserve Corps officers called into active service during the war were sent to one of the several Medical Department training camps. The Surgeon General held that a shorter course of instruction would permit more medical officers to receive a course of medico-military instruction prior to their assignment to duty either in the United States or overseas. The officer then in charge of the training camp division of the Surgeon General's Office expressed the opinion that one month should prove adequate for this training, provided it was limited to only a few major subjects, with an entire elimination of all strictly professional instruction. With this idea in view, the following orders covering a course of instruction were issued:

General Order No. 37.

HEADQUARTERS MEDICAL OFFICERS' TRAINING CAMP, *Fort Riley, Kans., July 16, 1918.*

1. A course of instruction will be given to officers assigned to this camp for duty for preliminary instruction prior to their permanent assignment to units or other detail. As a rule the officers to take this instruction will be those recently called to active service from civil life or those officers previously called who have not had the benefit of training camp work.

The following subjects will be taken up and the hours allotted to them as follows:

	Hours
Customs of the service and duties of the soldier.....	1
Demonstration of personal equipment, sanitary soldier, and field and surplus kits.....	1
Tent pitching, shelter half (1 hour); tent pitching pyramidal tent (2 hours).....	3
Tent pitching, hospital tentage.....	2
Regimental detachment, its equipment, use, and internal administration.....	4
Demonstration of regimental combat equipment.....	2
First aid, using soldiers' equipment only.....	1
Army Regulations, general orders, bulletins, special regulations, War Department, essential elements of.....	15
Manual of the Medical Department, essential elements of.....	15
Paper work, Medical Department, Quartermaster Department, Ordnance Department..	15
Demonstration of field sanitary appliances (2 hours); sanitary inspections (2 hours)...	4
Ambulance companies, equipment, use, and internal administration.....	4
Field hospitals, use, and internal administration.....	4
Manual for Courts-Martial and Military Law.....	3
Poison gases and liquid fire (2 hours); gas mask drill (2 hours).....	4
Demonstration of trench system.....	2
Equitation, including care of animals, saddling, etc. (each Saturday afternoon).....	4

2. The senior instructors in Army Regulations, Manual for the Medical Department, paper work (Medical Department), and officers in charge of drills, at the end of their subject will hold an examination and submit their marks on the student officers' work. Instructors in the other subjects will not submit marks but will make report to the commanding officer if any student officer's work is not satisfactory.

3. The director ambulance companies, director field hospitals, and officer in charge regimental detachments (now casals) will submit marks on the general efficiency and adaptability demonstrated by the student officers assigned to them for temporary duty in their departments, respectively.

4. This school of instruction will be held for all student officers, whether assigned to ambulance companies, field hospital companies, or regimental detachments, and if practicable only one class will be held for the entire course. All student companies take the several classes and subjects at the same time, irrespective as to when they are organized.

5. The schedule of instruction consists of four weeks, called first, second, third, and fourth week course. By keeping a record at headquarters of the course of instruction and day of that week in which the officer began his course he will receive his entire course, provided he remains at the school for four weeks.

By direction of Lieutenant Colonel Pipes:

J. N. SHERMAN,

Captain, M. R. C., Assistant Adjutant.

General Order No. 38.

HEADQUARTERS MEDICAL OFFICERS' TRAINING CAMP,
Fort Riley, Kans., July 16, 1918.

1. In addition to their other duties, the following officers are detailed as instructors in connection with the School of Instruction, medical officers' training camp, as follows:

SENIOR INSTRUCTOR	SUBJECT
Captain Abraham.....	Customs of the service and duties of the soldier. Demonstration of personal equipment, sanitary soldiers, and field and surplus kits. Tent pitching, shelter half tent pitching, pyramidal tent pitching, hospital tentage.
Major Clark.....	Regimental detachment, its equipment, use, and internal administration. Demonstration, regimental combat equipment.
Lieutenant Baird.....	First aid, using soldier's equipment only.
Major Kinard.....	Army Regulations, general orders, bulletins, special regulations of War Department.
Lieut. Carl Davis.....	Essential elements of Manual for the Medical Department.
Major Morrill.....	Essential elements of paper work, medical quartermaster, Ordnance Department.
Lieutenant Bayer.....	Demonstration, field sanitary appliances, sanitary inspectors.
Lieutenant Colonel Cook..	Ambulance company, its equipment, use, and internal administration.
Major Wetherbee.....	Field hospital, its equipment, use, and internal administration.
Major Peters.....	Manual for Courts-Martial and Military Law.
Lieutenant Halley.....	Poison gases and liquid fire and gas-mask drill.
Captain Pickard.....	Demonstration of trench system.
Lieutenant Hennessey.....	Physical drill and sanitary drill.
Lieutenant Baird.....	Equitation, including care of animals, saddling, etc.

By direction of Lieutenant Colonel Pipes:

J. N. SHERMAN,

Captain, M. R. C., Assistant Adjutant.

Copies of these orders were sent to the Surgeon General, who decided that the new course of instruction should be extended from the period of one month to that of six weeks. This was accomplished by the following order:

General Order No. 39.

HEADQUARTERS MEDICAL OFFICERS' TRAINING CAMP,
Fort Riley, Kans. August 19, 1918.

1. Beginning September 1, 1918, the official course of instruction at this camp for student officers will extend over a period of six weeks.

2. A similar course of instruction for a like period will be begun on the 1st day of each succeeding month for such officers as shall have reported for same.

3. The officers who remain after the completion of their course of six weeks will continue to receive instruction until permanent assignment is made for them. This instruction will begin the 15th day of each month and will be for the most part practical and will be given under the supervision of the directors of field hospital companies and of ambulance companies. Future orders from headquarters will govern assignment of such officers as remain for this instruction.

4. In addition to their other duties the following officers will give a course of instruction in the subjects as herein specified in the School for Medical Officers to begin September 1, 1918:

	Hours
Army Regulations, essentials of (Maj. K. W. Kinard, M. C.)	18
Demonstration of field sanitary appliances (Capt. A. G. Byers, M. C.)	2
Demonstration of field combat equipment (Lieut. R. A. Hennessey, M. C.)	2
Demonstration of trench system (Lieut. R. A. Hennessey, M. C.)	2
Duties of personnel adjutant (Capt. W. L. Nelson, M. C.)	2
Examination of recruits with papers and finger prints (Maj. A. M. Farrell, M. C.)	8
Field Service Regulations, essentials of (Lieut. Carl Davis, M. C.)	5
Field and surplus kits; care and maintenance of soldier's equipment (Capt. E. H. Morgan, M. C.)	1
General organization of Medical Department for war (Lieut. Carl Davis, M. C.)	1
Handling of rations and mess management (Lieut. H. I. Conn, M. C.)	2
Manual for the Medical Department, essentials of (Maj. F. H. Dammasch, M. C.)	18
Manual for Courts-Martial and Military Law, essentials of (Maj. J. D. Peters, M. C.)	5
Map reading, use of compass, orientation, road sketching, etc. (Capt. F. E. Ellison, M. C.)	7
Military hygiene and sanitation, essentials of (Maj. H. C. Parker, M. C.)	9
British Medical Service at the front (Maj. W. B. McDermott, C. A. M. C.)	5
Paper work relating to Ordnance Department, essentials of (Maj. F. H. Dammasch, M. C.)	2
Paper work relating to Quartermaster Department, essentials of (Maj. F. H. Dammasch, M. C.)	4
Paper work relating to the Medical Department, essentials of (Maj. F. H. Dammasch, M. C.)	12
Poison gases, protection against, symptoms and treatment (demonstration); liquid fire (Capt. G. D. Halley, M. C.)	2
Practical demonstration of saddling, bridling, and grooming; care of leather (Capt. Robert J. Coffeen, V. C.)	4
Tent pitching, hospital tentage (Capt. H. C. Parsons, M. C.)	2
Tent pitching, shelter tent (Capt. H. C. Parsons, M. C.)	2
Tent pitching, pyramidal and wall tent (Capt. H. C. Parsons, M. C.)	2
Tent pitching, ward tent (Capt. H. C. Parsons, M. C.)	2
The ambulance company, its equipment, use, and internal administration (Capt. V. R. Abraham, M. C.)	6
The field hospital, its equipment, use, and internal administration (Maj. J. R. Wetherbee, M. C.)	7
The Medical Department in campaign and sanitary tactics (Maj. H. C. Parker, M. C.)	5
The regimental detachment, its use and internal administration (Lieut. R. A. Hennessey, M. C.)	4
The service and mechanism of supply in the field (Lieut. Donald J. Enfield, M. C.)	1
Tactical use of Infantry, Cavalry, and Field Artillery (Capt. E. H. Morgan, M. C.)	1

	Hours
Gas-mask drill (Capt. G. D. Halley, M. C.)	2
Equitation and hikes (hikes, Capt. A. E. Westervelt, M. C.; equitation, Lieut. B. A. Baird, M. C.)	38
Practical demonstration, medical service, zone of the advance, including regimental detachment and sanitary train, complete	12
Total hours for course	195

Because of the shortage of instructors, it was realized from the beginning that the only possible system of instruction that could be adopted was a rotary course, in which all of the student officers were in one large class. Immediately upon reporting to the camp, the new medical officer was assigned to this class where he took up the course of instruction then going on. As the class work was continuous and repeated, at the end of one month, and later six weeks, each officer covered the entire course of instruction. This method was not as efficient as that of the former system of instruction followed at Fort Riley, where instruction was given by companies, and, therefore, in comparatively small classes, which permitted not only lectures but recitations. When the course was of one month's duration, four schedules of instruction were issued one for each week as follows:

Schedule for the first week's instruction

1. Reveille. Hours designated by camp orders as to roll calls.
2. Setting-up exercises for 20 minutes, beginning immediately after reveille roll call. Daily except Sunday and holidays.
3. Breakfast, followed by police of barracks, etc.
4. 7 to 8 a. m. sanitary drill, daily except Friday, Sunday, and holidays; 7 to 8, camp gymnasium, Friday.
5. 8.15, Saturday, student company inspection by officer in charge of student companies.
6. 8.15 to 11.30, daily except Sunday, student officers will be reported to organizations to which they have been temporarily assigned to duty, namely, duty with ambulance company, field hospital, and regimental detachment (casuals at present). On Saturday student officers report immediately after Saturday morning inspection.
7. School for medical officers.

During the summer of 1918, on account of the heat, class instruction was given out of doors in one of the numerous natural amphitheaters created by deep, shady gullies in the camp. Later, when the weather grew cooler, class instruction was given in the large auditorium, close to headquarters. Supplementary to the theoretical course heretofore described, a practical course of instruction was given by the commanding officer of the Second Sanitary Train, to which organization student officers were assigned prior to their transfer from camp. This could not always be done because of the numerous orders received transferring medical officers away from the camp. In the sanitary train an intensive practical course of instruction was given in ambulance company and field hospital work. The ambulance companies and field hospitals of the Second Sanitary Train at Fort Riley were motorized.

It had formerly been the custom of the commanding officer to recommend to the Surgeon General the assignment of student medical officers. Orders were then requested from The Adjutant General of the Army and transfers effected, usually as recommended. After the establishment of the new camp,

this method was not followed out, and all orders were received direct from The Adjutant General ordering the transfer of medical officers by number and not by name. No information was given as to the character of the service required, other than that inferred from the place covered by the particular order. Each officer was interviewed by the commanding officer of the camp and an estimate made upon his fitness for service based upon his character, appearance, address, military bearing, and reported efficiency in class work. The officers were then sent to their designated places by camp orders, and telegrams were sent to The Adjutant General and the Surgeon General giving the name of each officer transferred and place to which transferred.

GENERAL COURSE OF INSTRUCTION FOR ENLISTED MEN

The source of enlisted personnel of the camp was mainly by draft from Kansas and States contiguous thereto. Toward the latter period of the life of the camp, orders were received for the transfer of 3,000 men from Camp Funston, Kans., for the organization of units for overseas service, but only a small portion of these men were transferred to Fort Riley.

Instruction of the enlisted men was placed in the hands of the officer in charge of the casual detachment. The work taken up was the school of the soldier, marching, tent pitching, individual cooking, and other training for field service. Full field equipment of the enlisted men of the Medical Department was not available at Fort Riley for issue to all enlisted men. This was due to the scarcity of equipment in the United States and its conservation for issue to troops upon arrival overseas. This shortage of essential articles of individual equipment was an impediment to the thorough instruction of troops.

Noncommissioned officers were appointed to all grades by the commanding officer in accordance with existing orders. On August 24, 1918, a school of instruction for noncommissioned officers, with a view to their training for commissions in the Sanitary Corps, was established. This course of instruction was covered by the following order:

General Order No. 41.

HEADQUARTERS MEDICAL OFFICERS' TRAINING CAMP, *Fort Riley, Kans., August 24, 1918.*

1. A school for noncommissioned officers, with a view of their training for commissions in the Sanitary Corps for special service with sanitary detachments, will be established at the camp and will commence Tuesday, August 27, 1918.

2. Old headquarters building is assigned as the assembly hall for this school.

3. The following officers and nonecommissioned officers, in addition to their other duties, are assigned as instructors in the subjects indicated after their names, together with the time allotted to each subject.

4. Maj. K. W. Kinard, M. C., in addition to his other duties, is detailed as officer in charge of this school.

Name	Subject	Hours
Capt. Carl H. Davis, M. C.	Army Regulations	9
Capt. A. G. Byers, M. C.	Clarification and purification of drinking water	1
	Cremation and disposal of animal remains	1
	Demonstration of field sanitary appliances	3
	Hygiene and sanitation, essentials of	12
Capt. F. E. Ellison, M. C.	Inspection of garbage dumps, Fort Riley and Pawnee	4
	Drafting room, sanitary appliances	27
	Map reading, use of compass, orientation, etc.	3
	Road sketching	3
Maj. H. C. Parker, M. C.	Field Service Regulations, essentials of	3
Capt. H. C. Parsons, M. C.	Service zone of advance	2
Lieut. J. W. Sellards, M. C.	Medical supplies, methods of obtaining same	1
Maj. J. D. Peters, M. C.	Manual for Courts-Martial, essentials of	4
Capt. G. D. Halley, M. C.	Poison gases and liquid fire	2
Capt. W. F. Speers, M. C.	Inspection of barracks	4
	Inspection of water carts	3
Lieut. W. S. Holmquist, M. C.	Inspection of storehouses	3
Lieut. J. L. Wooden, M. C.	Inspection of latrines	3
Lieut. E. L. Zimmerman, M. C.	Inspection of kitchens	4
Lieut. H. J. Barker, M. C.	Inspection of stables	4
Capt. E. A. Baker, M. C.	Camp inspection, with report	10
M. H. Sergt. E. Stevenson, M. D.	Paper work, Ordnance Department	2
	Paper work, Quartermaster Department	4
M. H. Sergt. Hugo Winkler, M. D.	Paper work, Medical Department	12
Sergt. (First Class) E. F. Crabb, M. D.	Manual for the Medical Department, essentials of	10
	Poisons, chemical tests for	1
	Poisons and antidotes	2

By order of Lieutenant Colonel Pipes:

J. D. ENFIELD,

First Lieutenant, M. C., Assistant Adjutant.

Thirty-eight noncommissioned officers and two privates took this course, Athletics and physical training of the enlisted men were placed in charge of one officer who had had considerable experience in such work. Baseball, football, and basket ball were taken up.

A letter was received from the Surgeon General under date of November 21, 1918, stating that orders had been issued by The Adjutant General of the Army that all shipping schedules designating troops for early service overseas had been revoked. Meanwhile orders were received directing the discharge of emergency officers and enlisted men. All such officers were examined physically prior to their discharge and sent to their homes. Orders were then received to transfer all property to Fort Riley, Kans., excepting Medical Department property, which was turned over to the medical supply depot at Camp Funston. During December, 1918, and January, 1919, there was a progressive reduction of the strength of the command. All enlisted men regularly enlisted in the Army and not eligible for discharge were transferred to places designated by The Adjutant General. Orders were requested for the Regular medical officers, and finally on February 4, 1919, the medical officers' training camp was formally closed. Prior to its final abandonment the entire camp was thoroughly policed, and after rigid inspection of all buildings and grounds the camp was turned over to the commanding officer, Fort Riley.

FORT BENJAMIN HARRISON, IND.^m

ORGANIZATION

The medical officer who had been detailed to act as commanding officer of the training camp²⁵⁵ arrived on May 23, 1917. The buildings, which had been ordered to be ready for occupancy on June 1, by 600 student officers,¹ were only partially completed, and the equipment was meager. The camp opened, however, on June 1, with 118 student officers, 9 Regular officers (who had been ordered to report as instructors), 150 recruits, and 1 female clerk.

SANITATION

The sanitation of the medical camp was at all times as good as general conditions would permit; the sanitation of the military reservation as a whole was unsatisfactory for some weeks. To a certain extent this was inevitable, as the rapid change of the place from a garrisoned post to a great camp of recruits entailed the presence not only of recruits, but also of thousands of civilian laborers and hundreds of hired teams of horses, with the result that soil pollution got far ahead of conservancy measures, and fly breeding was extensive. Up to August 10 these conditions were not within the control of the medical officers' training camp, but on that date the commander of Fort Benjamin Harrison issued an order placing sanitary control of the reservation in the hands of the commandant of the camp, and providing means for making the control effective. Thereafter the faulty conditions were rapidly corrected and the process of correction constituted valuable instruction in sanitation.

INSTRUCTION

OFFICERS

The course of instruction followed the outline prescribed by the War Department,²⁵⁶ which had been arranged to cover schedules of 10 hours' work per day for 13 weeks. Schedules for June, July, and August were prepared accordingly.

The plan was to divide the student officers into companies, each to be commanded and instructed, in accordance with the schedule, by an officer of the Regular service. Each of the Regular officers had assigned to him in addition a subject or subjects in which he was to act as specialist and supervisor of instruction in all companies; for example, one officer was to plan and supervise all instruction relating to courts-martial, another that of equitation, another that of field hospital work. This plan was very good fundamentally, but many obstacles arose to interfere with its execution, notably among them being the following: (a) The irregular arrival of new men, which necessitated the placing of some in classes which had gone over from a few days to some weeks of instruction; or, as an alternative, starting new classes with inexperienced reserve officers in charge. The former procedure was the more satisfactory for a while, but the increase in numbers and the progress of the course necessitated change to the latter; (b) frequent calls to send officers away from the camp for foreign

^m Unless otherwise indicated, the statements herein are based on: History of Medical Officers' Training Camp, Fort Benjamin Harrison, Ind., by Col. P. M. Ashburn, M. C., Nov. 30, 1917. On file, record room, Surgeon General's Office 354.6 (Fort Benjamin Harrison, M. O. T. C. (C)).

service or duty in other places; (c) frequent calls to give numbers of officers training for special work, to be taken up at early dates; (d) organization of units which demanded the whole time of officers assigned to them.

The broad outlines as given in the course of instruction prescribed by the War Department²⁵⁶ were followed as closely as possible. Every effort was made to have the instruction given by, or under the direct personal supervision of, Regular medical officers, to which end a Regular officer was assigned over as small a group of student officers as the supply of Regulars allowed. In general, each instructor had under him from 100 to 150 student officers. He could keep in touch with that number, learn their names, faces, and capacities, adapt instruction to individual needs, and answer the numerous questions which could be answered out of extensive experience, rather than out of books.

All student officers, despite their rank, on arrival were required to remove their insignia and to assume the rôle of cadets for a time under a company commander and two assistants. Each Regular officer instructor had reserve officers as assistants, who, in time, came to be valuable teachers. It was not to be expected, however, that they would be able to take the place of Regular officers. It was the unanimous opinion at the camp that the personal influence and teaching of the Regular officers was the most important part of the instruction scheme.

The lectures and quizzes were given in the company mess halls, except in very hot weather, when they were given in shaded groves in the camp. In addition to the routine class instruction, each Regular officer had assigned to him some subject or subjects which he was to prepare for or give to the entire camp, either in mass assemblage or by companies or sections. He was responsible for this instruction, whether he gave it in person or through assistants. These individual officers were responsible for instruction in map reading, road sketching, and field problems; hospital work and tent pitching; ambulance company work; regimental detachment work; equitation; and so on through the list. At first, they gave this instruction in person, and some of it was so given throughout the entire period; however, as assistants became sufficiently trained, their services were utilized for this purpose, under the supervision of the responsible officers. Later, certain reserve officers with special training in certain subjects assumed full charge of instruction in these subjects. For example, one officer taught the care of wounds in battle-front hospitals, another gas defense, and another examination for pulmonary tuberculosis, and as stated before, many reserve officers gave valuable lectures on special subjects.

By the beginning of July it was apparent that newly arriving officers were at a disadvantage if placed in companies which had already received a month of the course of instruction; the number of arrivals was also increasing so rapidly as to show the necessity for forming new companies. No additional Regular officers were obtainable as instructors, and it was intimated that some of those at the camp might be ordered away. So it was determined to put two understudies at work with each Regular, at the same time realizing the impossibility of developing them into capable instructors in all the duties of the Medical Department in a few months. It was pointed out to the Surgeon General that it was much easier to develop men into capable field officers and

send them out to the front in place of Regulars than to have them take the place of Regulars in a camp of instruction. Attention of the Surgeon General again later was called to the impracticability of using reserve officers as instructors, but it was not possible to furnish any more Regular officers, as the need for services elsewhere was too great.

As previously noted, one of the disadvantages of the plan of instruction was that it extended over a period sufficiently long to entail the calling away of men before the completion of the course. On such occasion, the question of the advisability of shortening the course arose. In view of the fact that more than half of the medical officers ordered to duty with troops went directly from their homes to that duty without any preliminary training, it appeared that it would have been preferable to plan for an intensive course of adaptation for all extending over a period of six weeks rather than the present plan of giving a minority of men a course lasting twice as long. No change in this direction was made, however, during the first three months' course. Later it became necessary to extend the use of reserve officers as teachers. This resulted in a lessening of interest on the part of the student officers and in a lowering of the efficiency of the work.

On July 30 the commandant received word from the Surgeon General that on August 24 personnel to form training cadres for the sanitary trains of the National Army would have to be sent out.

This made it necessary to bring about an almost complete rearrangement and reorganization of the units then in camp. The 4 field hospitals and 4 ambulance companies had to be split into 6, regimental detachments had to be split and rearranged, student officers had to be reassigned, and other changes made. It was apparent that at least 6 field hospitals and 6 ambulance companies would have to be made, 5 to be sent out and a skeleton one to be kept to look after the equipment of the departing companies. These contemplated withdrawals, and resulting changes again seriously interfered with the regular schedule, as it became necessary to concentrate upon the training and instruction of the new units of sanitary trains which were to go away. The plan then outlined and subsequently carried out in larger part was that one hospital company and one ambulance company should be sent to each of five National Army camps, where each was to expand into and form the training cadre of a battalion, the hospital company thus developing into a hospital battalion, the ambulance company into an ambulance battalion.

ENLISTED MEN

The instruction of the enlisted men was carried on intensively from the beginning, mainly under four experienced Regular officers. Noncommissioned officers were developed in fair numbers and the field work of the detachments and units was brought to and kept in a good state of efficiency. All enlisted men not belonging to the units formed were organized into and trained as regimental sanitary detachments.

SUMMARY

Supplies and men continued to come in until the end of September, but by that time it was definitely known that the camp was to close by the 1st of December (1917), and thereafter efforts were concentrated on giving as much training as possible to men who had arrived. This was mainly training in field work and administration, although some effort was also made to give instruction in special medical subjects, such as diagnosis of cardiovascular conditions and tuberculosis, Roentgenology, and orthopedies. Special classes were also trained for work as adjutants, registrars, and in other administrative positions.

The training in medical specialties was never carried to the extent in this camp to which it was later carried at Camp Greenleaf; it was not believed by the commandant that a training camp such as those established in 1917, operated under the conditions there obtaining, was a satisfactory place in which to give such training. Nevertheless good was accomplished by standardizing methods and technique and increasing the general effectiveness of the average of men doing special work.

The strength of the camp at 15-day intervals was as follows:

	Officers	Enlisted men		Officers	Enlisted men
June 1.....	12	150	Aug. 31.....	1,188	1,444
June 15.....	318	680	Sept. 15.....	1,148	1,589
June 30.....	494	1,491	Sept. 30.....	1,267	2,083
July 15.....	525	2,182	Oct. 15.....	1,207	2,083
July 31.....	578	2,495	Oct. 30.....	992	2,061
Aug. 15.....	1,089	2,703	Nov. 15.....	718	1,765

Altogether 2,141 officers and 4,211 enlisted men passed through the camp.

The units organized were 4 field hospitals, 4 ambulance companies, and 1 evacuation hospital. The field hospitals and ambulance companies were twice formed, as almost their entire personnel was ordered away in August to form units elsewhere. In addition to the units organized here, 1 field hospital and 1 ambulance company of the Indiana National Guard and 1 base hospital unit were sent to the camp for training.

The camp was closed on December 2, 1917.

FORT DES MOINES, IOWA *

(For Colored Officers and Enlisted Men)

ORGANIZATION AND ADMINISTRATION

The training camp for colored medical reserve officers and enlisted men of the Medical Department was organized July 26, 1917, at Fort Des Moines, Iowa. The course of instruction is outlined in the following letter:²⁵⁷

1. A training camp for colored medical officers has been authorized established at Fort Des Moines, Iowa, under first indorsement (354.1). The Adjutant General's Office,

* Unless otherwise indicated, the facts stated herein are based on: Report of Activities, Medical Officers' Training Camp, Fort Des Moines, Iowa, July 26 to Nov. 13, 1917. By Lieut. Col. E. G. Bingham, M. C., commandant. On file, Record Room, S. G. O., 354.6 (Fort Des Moines, Iowa, M. O. T. C.).

dated July 10, 1917. The capacity of this camp is 50 student officers, colored, and 10 regimental sanitary detachments, colored, for use in training colored medical officers and to meet the needs of colored troops as these are later organized.

2. This training camp will be under the immediate jurisdiction of the local commander for purposes of administration and supply. It is under the Surgeon General in respect to all matters relating to the work of instruction. For the latter purpose, the surgeon, Fort Des Moines, will direct and be responsible for all matters of instruction.

3. These instructions are intended to coordinate the work at the various medical camps of instruction so that it will be carried out on common lines.

Also so that the instruction given at these camps, and that which it is proposed to give the medical personnel necessarily serving with troops to meet their needs in the field and at posts, shall have similar basis and method.

To the end that the instruction to be given and the results to be secured shall be standardized, the general provisions of this letter will be strictly carried out. All details of execution are left to you, and you are held responsible for proper results.

4. The course at the medical officers' training camps is intended to give the student officers a general idea of the basic duties of a medical officer and prepare them for service with troops in the field. Training will be intensive and pushed as rapidly as possible.

5. The training to be given is intended to prepare these officers to conduct the service of the Medical Department without either the supervision of experienced medical officers or the aid of well-qualified noncommissioned officers. The limited number of these two classes in the Medical Department, and the necessity of assigning many of them to important administrative duties, renders it possible that few, if any, will be available for regimental duty.

For this reason, also, upon the reserve medical officers graduated from these training camps will fall the duty of themselves drilling and training the thousands of enlisted raw recruits which will be assigned to the Medical Department, and they must be put into a condition to carry out effectively this most important work.

6. Your camp will have accommodations for 50 student medical officers. They will be organized into a company, duly officered and noncommissioned officered from among themselves, and trained on a basis of medical cadets. It is desired to impress upon these new officers, by actual experience, what will later be required by them of their subordinates.

7. Your staff will be composed of all Regular medical officers at your post, who will be instructors in addition to their other duties. Due to the shortage of Regular officers, specially qualified militia or reserve medical officers may be assigned to such duty. Officers with regimental detachments will, in addition to their duties as such, serve as instructors.

You will make such assignments to instruction duty as you deem best, making due effort to assign to each subject officers known to you to have given special attention thereto and to possess ability to impart information.

You are authorized to use as instructors any student officers found specially qualified in any subject, and to give them special authority while so serving, irrespective of rank.

Your staff of instructors will, if desired, give the necessary instruction in hygiene and first aid to the line-officer candidates of the adjacent training camp. Conversely, you should ask the assistance of the line-officer instructors at line camps in teaching map reading, in special lectures, and in the tactical part of medicomilitary problems and maneuvers.

8. Instruction by lectures, except in special subjects, will, as far as possible, give place to recitations. Lectures are not considered as effective as recitations in imparting detailed information, nor do they afford opportunity to test the capacity and grade the student.

Lessons will, therefore, be assigned in the authorized textbooks, and quizzes held thereon, for the purpose of grounding them in theory and insuring that a competent knowledge of methods and principles has been acquired.

9. But coincident with the theoretical instruction, the student officers should as far as possible be made to visualize the organizations, apparatus, and methods concerned. In addition to study and lectures, it is most important that they should learn by seeing and doing. So far as possible, instruction will be made practical.

To this end, for example, specimens of all sanitary appliances and methods likely to be of use in field work will be procured or constructed, and continually kept in effective operation at the camp, and the officers will be shown their purpose and practical use.

Bombproofs for trench warfare and gas chambers for practical trial of protection against poison gases will be constructed.

In connection with paper work, all papers required by the medical and other departments will be actually made out until familiarity therewith and correctness of result is secured.

Mess management, taught in theory, will be actually demonstrated in the organization kitchens. Applied camp sanitation will be taught by sanitary inspections. Drill will be taught until every officer can himself effectively handle and instruct therein the units and detachments of the Medical Department.

The internal economy and administration of regimental detachments will be taught not only by books but by assignment to such organizations and quartering and subsistence therewith, and by actually handling them in marches and comprehensive field problems. To permit of the latter it is expected that 10 regimental sanitary detachments, all complete and kept recruited up to war strength, will be organized at your camp without delay. The regimental detachments will be organized as three provisional companies, to be split into their integral regimental parts for demonstration purposes.

10. You will assign student officers to duty with regimental detachments, as their officers and as supernumeraries, to familiarize them with these organizations, the handling of men, etc. Officers so assigned should be quartered and messed with these organizations, but will pursue the regular curriculum of training at the camp. Assignments as supernumeraries should be made in rotation, and ordinarily for 30 days with each organization.

11. The training course will be divided into three periods, of one month each. The first, while instructing the officer as such, is intended especially to familiarize him with the duties of his enlisted subordinates whom he must shortly train. The second takes up his training in his own special functions as an officer. The third carries on and completes the work of the second period.

New training classes should as far as possible be started at the conclusion of each month's training period. However, to meet immediate needs, officers needing training will be sent to camps at any time and will be organized at once into groups for instruction.

12. The following textbooks are authorized for the course of instruction: Army Regulations, Manual for the Medical Department, Field Service Regulations, Drill Regulations for Sanitary Troops, Manual for Courts-Martial.

These books will be invoiced to you without requisition. You will issue one copy of each to each student officer, who will take them with him when he leaves camp for duty elsewhere for reference and use in training his subordinates.

Maps and war-game sets will be sent without requisition.

You will procure maps of the maneuver grounds in the vicinity of your camp from the commanding general of your department. One map should be available to each student officer.

13. The following school textbooks will be sent you without requisition. They are for use in your training work and will not be taken away by officers.

Field Physical Training of Soldier, Koshler.

Special Regulations No. 23.

Manual of Physical Training, Koshler.

Technical Military Dictionary (English-French and French-English), Willcox.

Manual for Noncommissioned Officers and Privates of Infantry, 1917.

Handbook for Sanitary Troops, Mason.

Medical Service in Campaign, Straub.

Elements of Military Hygiene, Ashburn.

Principles of Sanitary Tactics, Munson.

Military Hygiene, Havard.

Sanitation in War, Lelean.

Gunshot Injuries, LaGarde.

Military Surgery, Penhallow.

Surgery in War, Hull.

Also Merton's life-size first-aid charts.

In addition, a miscellaneous assortment of reprints, bulletins, etc., will be sent you for reference and distribution. Also a series of current medical publications.

14. The daily instruction, except Saturday afternoon and Sunday, should approximate seven and one-half hours.

It is left to the commandant of each medical officers' training camp to prepare schedules for the hours available in each period of instruction among the subjects and time therefor required. This will enable the meeting of the needs of emergency, stormy weather, etc. Copies of the detailed schedules so prepared by you will be furnished this office as soon as practicable.

15. The following general scheme is suggested for the daily schedule for the first month:

* * * * * *

16. On this general plan, 180 hours of formal instruction will be given monthly. While the colored medical officers will be assigned to regiments, they should of course be instructed in the work of the Medical Department as a whole. No evening exercises are contemplated. Time will be needed for study. Saturday afternoon should be a rest period. Officers should be encouraged in equitation on Sunday, preferably in form of tactical ride. The schedule provided for a total course of 580 hours of instruction.

17. The following scheme shows the proposed scope and distribution of training of medical officers during the first period of one month of 30 days:^b

* * * * * *

18. Dental surgeons will be required to take the general course for medical officers, with the exception of the subjects which pertain more or less exclusively to the work of medical officers as such, and with the substitution therefor of subjects directly relating to the dental service. Pending instructions from this office, you will arrange tentatively for this special instruction.

19. If any reserve officer is found unfit for the service by reason of physical, mental, moral, or temperamental reasons, you will, on vote of your staff of instructors, recommend him to this office for separation from the service.

20. Attention is invited to the administrative as well as training problems presented by your camp. The medical officers under training must be sheltered, fed, supplied, and administered, their camp policed, wastes disposed of, mounts cared for, etc.

The personnel of the regimental detachments will, in addition to their other duties, be used by you as a service corps to carry out the above duties.

21. You will, without delay, secure definite accommodations and facilities for your medical training camp, in respect to the other training camp near by, so that there may be no later interruptions, modifications, or curtailment of the work of the Medical Department camp.

22. The medical officers' mess will not be supported from Government funds. Doubtless the quartermaster can furnish the necessary kitchen and mess equipment. Cost of mess will be charged on the officers' mess bills.

23. For the purpose of practice in equitation, you will make requisition at once for the necessary number of mounts and saddle equipment therefor, on the basis of 1 mount for each 4 student officers. Make requisition also for the pack mules necessary to your 10 regimental sanitary detachments.

24. The sick from your camp will receive infirmary treatment from a camp infirmary to be maintained by you. Hospital treatment will be given at the hospitals provided for the needs of the local coordinated training camps as a whole.

You will arrange to have the use of this hospital for the instruction of medical officers in the administration of such hospitals, and the training of enlisted men as nurses and as surgical and dispensary assistants.

25. In conjunction with the training camps for medical officers, it is proposed to establish training camps for enlisted men of the Medical Department. As soon as possible you will prepare a tentative plan for the training of these men in conjunction with the medical officers' training camp and forward it to this office for consideration. Your student medical officers will have to be the instructors of the enlisted personnel under training.

^b See pp. 78, 79.

Course should be based on a three months' period, having in mind that the needs of the service may require the detachment of some of these men after six weeks' or two months' training.

26. You will also prepare and submit a plan for the instruction of selected privates who have finished the basic course proposed in paragraph 24, with a view to their promotion as noncommissioned officers. This course should not exceed four weeks.

It is proposed to appoint men who, after satisfactorily finishing the basic course for enlisted men and the additional course for candidates as sergeants, are reported by you as qualified for such promotion.

27. Instruction as detachment cooks will also be given by you.

28. Receipt of this letter will be acknowledged.

For the Surgeon General:

_____,
Colonel, Medical Corps, United States Army.

The capacity of this camp as originally announced was changed later to accommodate 200 medical officers (colored) and 1,020 enlisted men (colored), Medical Department.

The commanding officer, Fort Des Moines, was in command for the purpose of administration and supply. The Surgeon General was in control of all matters relative to instruction. At first the post surgeon, Fort Des Moines, was placed immediately in charge of instruction. The staff of instructors at that time was composed of all medical officers at this post. On August 11, 1917, the organization of the camp was changed by the appointment of a commandant, who was to assume full control of all matters pertaining to instruction and administration. The commandant arrived at the training camp on August 20, 1917, and August 27 put into full operation a course of instruction for the medical officers and enlisted men. The course of instruction for the medical officers was maintained according to the outline quoted above, and will not be repeated here.

Upon the arrival of the commandant, three instructors were on duty with the camp. That this corps of instructors was inadequate was at once realized, and upon application to the Surgeon General additional instructors were furnished.

This camp was in operation 110 days, the entire period being divided as follows: (1) Preinstruction period, July 26-31, 1917; (2) part-time instruction period, August 1-26, 1917; (3) active and intensive instruction period, August 27, 1917, to date of closure, November 13, 1917.

During the first period the camp was getting ready to receive the student officers. During the second period the student officers had begun to arrive and continued to do so until the beginning of the third period. During this period, due to lack of instructors and the daily arrival of officers, only a limited amount of instruction was given. During the third period instruction was most intensive and was given up to the limit of assimilation. The progress made by the student officers and enlisted men during this period was very satisfactory to all concerned.

Of the 118 medical officers who received instruction, 8 failed to qualify, 4 were found incapacitated for physical reasons, 1 was disqualified for moral obliquity, and 1 was discharged for general unsuitability. The remaining 104 were assigned to various organizations of the 92d Division. Of the dental

surgeons who received instruction, all qualified. Of the 1,021 enlisted men, Medical Department, who received instruction, 68 were discharged for physical reasons, 1 for fraudulent enlistment, 1 on account of dependent relatives, and 1 to answer call of the selective draft; 2 deserted. The 948 remaining were sent to various organizations.

At no time, except during the last few weeks of its existence, did this camp have adequate or satisfactory quarters for the instruction or accommodation of the officers and enlisted men. A training camp for line officers (colored) was in operation here from June 12, to October 14, 1917, making it necessary to quarter many of our officers in Cavalry stables, as was done with all the enlisted men. Some of the officers were given quarters in a band barracks, and an officers' mess was maintained. However, only 48 officers could be accommodated there. This lack of proper and adequate quarters seriously interfered with the instruction and training, but was a condition not possible to remedy until about three weeks before the close of the camp. The stables were satisfactory as dormitories until cold weather, when they became very uncomfortable. Wooden floors were built in the stalls of four of these. Each stable accommodated 160 men and, although crowded, no real inconvenience arose from this condition, as ventilation was adequate at all times.

The messing and cooking were seriously defective, due to the fact that all barracks were occupied by the line officers' training camp, and no provisions could be made to take care of the one thousand and odd men of this camp. To remedy this defect an estimate was submitted for the erection of four fly-proof kitchens and mess halls and allotments to cover this were requested to be expedited. At the close of the camp no appropriation for these structures had been made. As a makeshift, enough material was secured from an abandoned National Guard camp to erect four screened kitchens, which served the purpose as well as could be expected. No provision in the nature of a screened mess hall could be secured, and the men were required to eat as if under field conditions. Cooking was done on the ordinary field ranges with the Alamo attachment; two such ranges to each cook shack. Food served was at all times good, well cooked, and adequate in quantity. The cooking was done by the enlisted men secured from the detachment. In this connection it was the aim to develop as many cooks as possible to fill this important place in the regimental detachments.

The same remarks as to messing and cooking apply in a measure to bathing. Four shower heads were all that were provided for a thousand men, which is not consistent with proper bathing facilities. By a mutual agreement between some of the company commanders of the line officers' training camp and the commandant of this camp, certain days were allotted to the medical camp for the use of the bathing facilities of those companies. This tided over an emergency that might have been a grave sanitary defect.

The total expenditure for this camp was but \$1,830, which was principally to cover the cost of flooring the stalls of the four stables used as sleeping quarters for the enlisted men.

All the men were adequately supplied with clothing, including woolen clothing and overcoats, when, on the advent of cold weather, the issue was warranted. The real defect in this connection, was the arrival at the camp of a large number

of men with ill-fitting shoes. Some men requiring a No. 7 shoe reported here wearing a No. 11. This was corrected as rapidly as detected.

A feature of the training camp much enjoyed by officers and men was a practice march and a three-day field encampment. The entire command was taken on a 10-mile march to the State fair grounds and lived under canvas (shelter tents) for three days, October 3-6, 1917. Practical instruction was given in camp-making sanitation, regimental detachment administration, camp-infirmatory work, packing, bearer work, and field work in general. There was no disorder or accident attending this march and encampment, which constituted a most valuable instruction period.

The Young Men's Christian Association maintained in this camp a branch which was a social and recreation center for the men. A well-equipped band was also organized from the enlisted men, which added much to the contentment and happiness of the men. A baseball team and a football team were organized from the enlisted men, and some games played with local teams. The enlisted men and officers generally attended in a body. With the camp band playing at the games, a goodly feeling of corps loyalty and union, not materially different from the college student spirit, was engendered to the noticeable and material gain in training efficiency. Boxing was encouraged, and one large boxing contest, which was attended by practically all of the instructors, officers, and enlisted men, was held in a large auditorium in Des Moines.

The total attendance of this camp was as follows: Medical Reserve Corps, 118; Dental Reserve Corps, 12; enlisted men, Medical Department, 1,021.

The health of the command remained uniformly good during the entire period of the camp. No epidemic of any disease appeared, though many cases of measles developed among the newly arrived men from the recruit depots. No outbreak of measles occurred, due largely to the rule established early in the camp of removing to the hospital all cases showing coryza and elevation of temperature immediately on discovery regardless of a diagnosis. A large contributing factor in the relative freedom from measles was the use of open Cavalry stables as barracks, for a variety of ventilation was obtained by necessity superior to that possible in a cantonment under canvas. No case of measles developed in any man who had been in camp more than two weeks. In all, 34 cases developed among 1,021 men and 130 officers, of 29.54 per thousand.

The discipline of the men and officers was uniformly very good. No difficulty presented itself in the camp. Passes to the city of Des Moines were freely granted and resulted in no abuse of the privilege or disorder in the city. Fewer of the men from this camp were arrested by the local police authorities than was normal among Regular troops.

INSTRUCTION

The general scheme of instruction issued by the Surgeon General was closely followed. However the camp naturally divided itself into three schools: (a) A school for officers; (b) a school for enlisted men; (c) a school for prospective noncommissioned officers.

The work of the several schools was closely coordinated, the officers in training serving as instructors in the school for noncommissioned officers and the school for privates in the more strictly professional topics.

Instructions from the Surgeon General directed the training of regimental sanitary detachments, and in practice this camp training was limited to this branch of the medical service. The other types of medical services were explained in lecture, only to familiarize the officers and men with the nature of such activities. It was found necessary because of the lack of adequate study halls and because of the fact that the officers did not grasp the subject readily, to give more hours of instruction in paper work and the Manual of the Medical Department than the outline from the Surgeon General prescribed. For a certain part of this instruction, three night periods of two hours each were added in practical paper work each week. Each officer was required to prepare the more commonly used forms and medical blanks, and these were carefully graded and criticized.

It is believed that the limitation put upon this camp to prepare regimental sanitary detachments only was a very happy decision, as more time could be given to regimental administration with associated larger consideration of the entire subject of Army Regulations, than would have been possible had it been necessary to give in detail the various phases of medical activity such as ambulance companies and field hospitals. The enlisted men were divided into detachments of 20 men each and placed under an officer in training. The squads were known as provisional sanitary detachments and were instructed as such. Two reserve officers were assigned to each provisional regimental detachment; eight such detachments were usually quartered together, and the whole known as a provisional company, and administered as such, one medical reserve officer being designated as company commander who was assisted by two sergeants out of the Regular Army detailed as assistant instructors and noncommissioned officers in charge of barracks.

The instruction was divided among the instructors detailed to this camp by subjects, each instructor being responsible for the instruction given in the entire camp in this particular subject; this worked very well in securing uniformity of instruction in each subject throughout the entire camp.

Most of the common field sanitary appliances were constructed and the officers and enlisted men were given daily a chance to see how each was constructed and operated. In the practice marches, the officers and men of each detachment were required to construct these appliances for the use of that march, using in this construction the knowledge they had gained in camp.

The instruction of each detachment was made the subject of criticism so that quite a bit of competition to excel the results of other detachments developed, which was believed to have been very beneficial in its results.

OFFICERS

The average age of all Medical Reserve Corps officers reporting to this camp was 32.79 years. Average age of all officers, Dental Reserve Corps, reporting to this camp was 29.83 years. The officers sent out from this camp were relatively young men, averaging 31.96 years. They were recently in practice from civil life, the average years of practice being 6.03 years. The older men were not found desirable. They could not grasp the situation, had

difficulty in studying the text, and were not as well educated as the younger men. The States and schools from which the officers come, with the numbers from each, follow:

Medical and dental reserve officers by States

Alabama	4	Massachusetts	1
Arizona	1	Mississippi	4
California	3	Missouri	6
Connecticut	1	Nebraska	1
District of Columbia	5	New Jersey	6
Florida	2	North Carolina	9
Georgia	10	Ohio	7
Illinois	7	Oklahoma	2
Indiana	7	Pennsylvania	3
Iowa	22	South Carolina	6
Kansas	3	Tennessee	16
Kentucky	10	Texas	2
Louisiana	2	Virginia	5
Maine	1	West Virginia	2
Maryland	2		

Medical and dental reserve corps officers (colored) by medical colleges

Maharry Medical College, Nashville, Tenn	43
Medico-Chirurgical College, Philadelphia, Pa	2
Northwestern University, Chicago, Ill	3
Leonard Medical College, Raleigh, N. C	13
University of Southern California, Los Angeles, Calif	2
Louisville National Medical College, Louisville, Ky	4
Starling Medical College, Columbus, Ohio	2
Boston College of Physicians and Surgeons, Boston, Mass	2
Howard University, Washington, D. C	22
University of West Tennessee	9
Knoxville Medical College, Knoxville, Tenn	1
Jenner Medical College	1
University of Pennsylvania, Philadelphia, Pa	2
University of Illinois, Chicago, Ill	3
New York Homeopathic Medical College, New York City	1
University of Vermont, Burlington, Vt	1
Boston University, Boston, Mass	2
Shaw University	1
University of Michigan, Ann Arbor, Mich	2
College of Medicine and Surgery, Chicago, Ill	1
Indiana University, Indianapolis, Ind	4
Harvard University, Boston, Mass	2
Columbia University, New York City	1
Louisville Medical College, Louisville, Ky	1
Reliance Medical College	1
Chicago College Dental Surgery, Chicago, Ill	2
Indiana Dental College, Indianapolis, Ind	1
Iowa State University, Iowa City, Iowa	1

The following schedule for the first six days of training will give a fair idea of the way in which the time and subjects for the training of the medical officers were divided.

First day (Aug. 27, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	Drill and school of soldier.
8.30 to 9.25 a. m.	Litter drill.
9.30 to 10.25 a. m.	Lecture, personal equipment.
10.30 to 11.25 a. m.	First aid, using soldier equipment, lecture and demonstration.
1 to 2.25 p. m.	Practical first aid.
2.30 to 4.30 p. m.	Bearer work with and without litter.

Second day (Aug. 28, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	School of the soldier.
8.30 to 9.25 a. m.	Letter drill.
9.30 to 10.25 a. m.	Field and surplus kits, equipment, medical officers.
10.30 to 11.25 a. m.	First aid, using soldier equipment only; lecture and demonstration.
1 to 2.25 p. m.	Practical first aid.
2.30 to 4.30 p. m.	Bearer work with and without litter.
7 to 9 p. m.	Reports, returns etc., pertaining to regimental detachment.

Third day (Aug. 29, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	School of the soldier.
8.30 to 9.25 a. m.	Litter drill.
9.30 to 10.25 a. m.	Care and maintenance of soldier equipment.
10.30 to 11.25 a. m.	Duties of a soldier; lecture and quiz.
1 to 2.25 p. m.	Practical first aid.
2.30 to 4.30 p. m.	Bearer work, with and without litters.

Fourth day (Aug. 30, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	School of the soldier.
8.30 to 9.25 a. m.	Litter drill.
9.30 to 10.25 a. m.	Care and maintenance of soldier equipment.
10.30 to 11.25 a. m.	Duties of a soldier; lecture and quiz.
1 to 2.25 p. m.	Practical first aid.
2.30 to 4.30 p. m.	Litter-bearer work, with and without litter.

Fifth day (Aug. 31, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	School of the soldier.
8.30 to 9.25 a. m.	Litter drill.
9.30 to 10.25 a. m.	General organization of military forces.
10.30 to 11.25 a. m.	Duties of a soldier; lectures and quiz.
1 to 2.25 p. m.	Practical first aid.
2.30 to 4.30 p. m.	Bearer work, with and without litter.
7 to 9 p. m.	Reports, returns pertaining to regimental detachment.

Sixth day (Sept. 1, 1917):

5.45 to 6 a. m.	Setting-up exercises.
7.30 to 8.25 a. m.	Inspection.
8.30 to 9.25 a. m.	Demonstration and familiarization with Medical Department equipment.
9.30 to 10.25 a. m.	Duties of a soldier; lecture and quiz.
10.30 to 11.25 a. m.	Articles of War; Manual for Courts-Martial; lecture and quiz.

ENLISTED MEN

The following is a schedule of progressive instruction, basic course for enlisted men.

SCHOOL OF INSTRUCTION FOR RECRUITS, MEDICAL DEPARTMENT, FORT DES MOINES, IOWA

Schedule of progressive instruction

FIRST WEEK

	5.45 to 6 a. m.	7.30 to 8.25 a. m.	8.30 to 9.25 a. m.	9.30 to 10.25 a. m.	10.30 to 11 a. m.	1 to 2.25 p. m.	2.30 to 4.30 p. m.
Daily, except Saturday and Sunday	Setting-up exercise	School of the soldier (pp. 9 to 25, Drill Regulations for Sanitary Troops)	Litter drill (pp. 43 to 57, Drill Regulations for Sanitary Troops)	Anatomy and physiology (pp. 37 to 88, Mason's Handbook)	First aid (pp. 89 to 140, Mason's Handbook)	Practical first aid resuscitation (Bull. 37), first-aid package, application of tourniquet, and arrest of hemorrhage	Bearer work: (a) Loaded litter, pp. 61-83, Drill Regulations for Sanitary Troops; (b) without litter, pp. 84-94, Drill Regulations for Sanitary Troops
Saturday	Setting-up exercise	Inspection (pp. 103 to 109, Drill Regulations for Sanitary Troops)	Demonstrate and familiarize with corps equipment	Duties of a soldier	Reading of Articles of War	No instruction	No instruction
Sunday				No instruction			

SECOND WEEK

	Setting-up exercise	School of detachment (pp. 36-42, Drill Regulations for Sanitary Troops)	Litter drill (pp. 43-57, Drill Regulations for Sanitary Troops)	First aid (Mason's Handbook, pp. 89-140)	Personal hygiene, elementary (Mason's Handbook, pp. 367-369)	Practical first aid, bandaging (Mason's Handbook, pp. 185-199) Applying Splints (Mason's Handbook, pp. 109-118, new edition)	Bearer work: (a) Loaded litter, pp. 61-83, Drill Regulations for Sanitary Troops; (b) without litter, pp. 84-94, Drill Regulations for Sanitary Troops
Daily, except Saturday and Sunday	Setting-up exercise	Inspection (pp. 103-109, Drill Regulations for Sanitary Troops)	Demonstration and familiarize with Hospital Corps man's equipment	Army Regulations	Reading Articles of War and portions of Manual of Courts-Martial.	No instruction	No instruction
Saturday	Setting-up exercise						
Sunday				No instruction			

THIRD WEEK

	5.45 to 6 a. m.	7.30 to 8.25 a. m.	8.30 to 9.25 a. m.	9.30 to 10.25 a. m.	10.30 to 11.25 a. m.	1 to 1.55 p. m.	2 to 2.55 p. m.	3 to 4 p. m.
Daily except Saturday and Sunday	Setting-up exercise	Drill school of detachment (pp. 26-42)	Drill litter (pp. 43-60, Drill Regulations for Sanitary Troops)	First aid (Mason's Handbook, pp. 89-140, new edition)	Camp hygiene (Mason's Handbook, pp. 337-366, new edition)	Nursing (Mason's Handbook, pp. 141-183, 200-257, new edition)	Practical first aid, advanced; emergency splints; bandages; use of first-aid package (see men in small detachments)	Bearer work: (a) With litter, pp. 61-83, Drill Regulations for Sanitary Troops; (b) Without litter, pp. 84-94, Drill Regulations for Sanitary Troops; (c) tent pitching drill, pp. 118-124, Drill Regulations for Sanitary Troops
Saturday	Setting-up exercise	Inspection (pp. 103-109, Drill Regulations for Sanitary Troops)	Continue demonstration and familiarize with Hospital Corps equipment	Army Regulation	Continue Articles of War and Manual Courts-Martial	No instruction	No instruction	No instruction
Sunday				No instruction	No instruction	No instruction	No instruction	No instruction
FOURTH WEEK								
	5.45 to 6 a. m.	7.30 to 8.25 a. m.	8.30 to 9.25 a. m.	9.30 to 10.25 a. m.	10.30 to 11.25 a. m.	1 to 1.55 p. m.	2 to 2.55 p. m.	3 to 4.30 p. m.
Daily except Saturday and Sunday	Setting-up exercise	Drill school of detachment (pp. 26-42, Drill Regulations for Sanitary Troops)	Litter drill (pp. 43-60, Drill Regulations for Sanitary Troops)	First aid (pp. 89-140, Mason's Handbook, new edition)	Camp hygiene (pp. 337-366, Mason's Handbook, new edition)	Practical nursing (pp. 141-183, 200-257, Mason's Handbook, new edition)	Continue practical first aid; emergency splints; bandaging; use of first-aid package; begin instruction on preparation of detachment for transport	Bearer work: (a) With litter, pp. 61-83, Drill Regulations for Sanitary Troops; (b) without litter, pp. 84-94, Drill Regulations for Sanitary Troops; (c) tent pitching drill, pp. 118-124, Drill Regulations for Sanitary Troops; (d) ambulance drill, pp. 95-101, Drill Regulations for Sanitary Troops
Saturday	Setting-up exercise	Inspection (pp. 103-109, Drill Regulations for Sanitary Troops)	Instruction and actual handling of Hospital Corps men equipment	Army Regulations	Articles of War	No instruction	No instruction	No instruction
Sunday				No instruction	No instruction	No instruction	No instruction	No instruction

SCHOOL OF INSTRUCTION FOR RECRUITS, MEDICAL DEPARTMENT, FORT DES MOINES, IOWA—continued

Schedule of progressive instruction—Continued

FIFTH WEEK

Daily except Saturday and Sunday	5.45 to 6 a. m.			7.30 to 11.30 a. m. and 1 to 4.30 p. m.	
	Setting-up exercise	(1) Use of shelter tents in the field. (2) Blanket-roll packs; field kit; preparation and use. (3) Diagnosis tags; preparation and use of same. (4) Preparation of patients for transport and transportation of same. (5) Construction of field appliances: (a) Straub kitchen incinerator. (b) Caldwell incinerator. (c) Rockpit crematory. (d) Field ovens. (e) Field ice boxes. (6) Field and camp sanitation. (7) Personal hygiene. (8) Demonstration of trenches; use of same.			
Saturday	5.45 to 6 a. m.	Inspection (pp. 103-104, Drill Regulations for Sanitary Troops)	Continue Articles of War, Courts-Martial Manual, Geneva Convention, etc.	8.30 to 11.30 a. m.	1 to 4.30 p. m.
Sunday			No instruction		No instruction

SIXTH WEEK

Daily except Sunday	5.45 to 6 a. m.			7.30 a. m. to 4.30 p. m.	
	Setting-up exercise	(1) Marching, rules governing. (2) Construction and use of Field Appliances: (3) Water purification. (4) Individual cooking and field messing. (5) Personal hygiene; camp and field sanitation; practical application. (6) Use of Hospital Corps and personal equipment; practical. (7) Use of combat equipment, and establishment of regimental aid station. (8) Organizing of parties for sick and wounded; preparation of diagnosis tags and tagging of patients; preparation for transportation of wounded; practical application of improvised splints, etc. (9) Practical use of trenches; evacuation of wounded. N. B.—In this period one 2-day practice march with one night bivouac will take place, actual field conditions prevailing. Two days of this period individual cooking will prevail.			
Sunday			No instruction		No instruction

NONCOMMISSIONED OFFICERS

On September 24, 1917, there was organized in this camp a school for prospective noncommissioned officers. The students for this school were selected from the enlisted men in the camp who had completed the basic course. It was the intention to develop the noncommissioned officers from the most suitable of these men and to appoint privates first class from the others. The basis for eligibility for this school was (a) general aptitude; (b) preliminary education—a minimum being the completion of eighth grade of public schools. Two hundred and ninety-one enlisted men were chosen to take this course. Six medical officers were assigned as instructors and the following course was inaugurated September 24, 1917.

AN ADVANCED COURSE OF INSTRUCTION FOR PROSPECTIVE NONCOMMISSIONED OFFICERS

	Hours
1. Organization and duties Medical Department, Sept. 24 to 26, 1917.....	6
2. Military hygiene and sanitation, Oct. 8 to 10, 1917.....	6
3. Hospital organization and ward management, Oct. 11 to 12, 1917.....	4
4. First aid and nursing, Oct. 15 to 18, 1917.....	8
5. Instruments and appliances, demonstration, Oct. 19 to 20, 1917.....	4
6. Materia medica and pharmacy, Oct. 20 to 21, 1917.....	6
7. Field equipment, Oct. 24, 1917.....	2
8. Army Regulations, Oct. 25 to 27, 1917.....	6
9. Articles of War interpolation and explanation, Oct. 30, 1917.....	2
10. Practical instruction in care of feet, Oct. 17 to 18, 1917.....	4
11. Care and accounting of public property and paper work, Medical Department, practical, Oct. 8 to 26, 1917.....	28
12. Cooking and mess management, Oct. 8 to 12, 1917.....	10
13. Field sanitation, practical construction of appliances, etc., Oct. 15 to 19, 1917.....	10
14. Equipment, field, combat and horse, practical use of, Oct. 24 to 25, 1917.....	4
15. Tent drills, special, Oct. 26, 1917.....	4
16. Equitation, care of animals, duties of orderlies, etc., Oct. 8 to 30, 1917.....	36
17. Bugle instruction, special for those selected for bulger's course.....	36
18. Minor surgery and nursing, practical (general anesthesia, disinfection, sterilization of instruments and dressings, catheterization, preparation and administration of enemata, gastric lavage, bed making, etc.).....	35

The early call (October 29, 1927) for privates and privates first class from this school for duty with the colored organizations elsewhere terminated the course before completion and before the men could become sufficiently well qualified to assume the duties of noncommissioned officers.

As a result of this 221 were appointed privates first class, but no noncommissioned officers were made from them.

FINAL DISPOSITION OF OFFICERS IN TRAINING

Medical Reserve Corps

I. Assigned to organizations, colored troops:	
(a) Camp Upton, Yaphank, N. Y.....	7
(b) Camp Meade, Annapolis Junction, Md.....	9
(c) Camp Sherman, Chillicothe, Ohio.....	3
(d) Camp Grant, Rockford, Ill.....	7
(e) Camp Dodge, Des Moines, Iowa.....	6
(f) Camp Dix, Wrightstown, N. J.....	6
(g) Camp Funston, Fort Riley, Kans.....	66
Total.....	104

2. Disqualified as unsuitable.....	9
3. Disqualified physically.....	4
4. Disqualified for moral obliquity.....	1
Total.....	14

Dental Reserve Corps

1. 77th Division, Camp Upton, Yaphank, N. Y.....	2
2. 78th Division, Camp Dix, Wrightstown, N. J.....	2
3. 79th Division, Camp Meade, Annapolis Junction, Md.....	2
4. 83d Division, Camp Sherman, Chillicothe, Ohio.....	2
5. 86th Division, Camp Grant, Rockford, Ill.....	2
6. 88th Division, Camp Dodge, Des Moines, Iowa.....	2
Total.....	12

Disposition of enlisted men in training at this camp

1. 301 Stevedore Regiment, Newport News, Va.....	28
2. 302 Stevedore Regiment, Newport News, Va.....	28
3. 303 Stevedore Regiment, Newport News, Va.....	28
4. 304 Stevedore Regiment, Newport News, Va.....	28
5. Engineer Service Battalion, Camp Taylor, Ky.....	12
6. Engineer Service Battalion, Camp Lee, Petersburg, Va.....	24
7. Engineer Service Battalion, Camp Travis, Fort Sam Houston, Tex.....	12
8. Engineer Service Battalion, Camp Pike, Little Rock, Ark.....	12
9. For duty with drafted colored men, Camp Travis, Fort Sam Houston, Tex.....	64
10. 317th Sanitary Train, Camp Funston, Kans.....	712
11. Discharged.....	71
12. Deserted.....	2
Total.....	1,021

This camp was closed on November 13, 1917.

REFERENCES

- (1) First indorsement from The Adjutant General to the Quartermaster General, May 11, 1917. Subject: Medical training camps. On file, Mail and Record Division, A. G. O., 2,581,692 (Old Files).
- (2) S. O. No. 116, W. D., par. 68, May 19, 1917 (detailing Col. Henry Page, M. C.).
- (3) History of Camp Greenleaf, November 1-30, 1917, by Col. Henry Page, M. C. On file, Record Room, S. G. O., 354.6 Camp Greenleaf (C).
- (4) Plan of Camp Greenleaf. On file, Record Room, S. G. O., 632 (General).
- (5) Administrative History, Camp Greenleaf, Ga., by Lieut. Col. W. N. Bispham, M. C. (undated). On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf) C.
- (6) Letter from the commandant, Camp Greenleaf, to the Surgeon General, U. S. Army, Washington, D. C., January 16, 1919, Subject: History of Medical Officers' Training Camp, Camp Greenleaf. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf) C.
- (7) Medical History of Camp Greenleaf, Chickamauga Park, Ga. (undated). On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf) C.
- (8) Monthly report of battalion group commander, student battalions, February, 1918, by Lieut. Col. E. M. Talbott, M. C. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (9) Letter from the senior instructor to the commandant, Camp Greenleaf, March 7, 1918. Subject: Report of instruction, February, 1918. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf) C.

- (10) Letter from The Adjutant General to the Surgeon General, March 14, 1918. Subject: General hospitals. On file, Record Room, S. G. O., 322.3 (General Hospitals) K.
- (11) Letter from the Surgeon General of the Army to the commandant, Camp Greenleaf, Fort Oglethorpe, Ga., April 13, 1918. Subject: Memorandum to heads of divisions, with correspondence attached. On file, Record Room S. G. O., 210.3 Camp Greenleaf (April 13).
- (12) First indorsement from the commandant, Medical Officers' Training Camp, Camp Greenleaf, Ga., to commanding officers, student officers' group, April 17, 1918. On file, Record Room, S. G. O., 210.3 (Student Officers, Camp Greenleaf) C.
- (13) Letter from the commandant, Camp Greenleaf, to Col. P. M. Ashburn, M. C., Surgeon General's Office, June 1, 1918. Subject: Camp Greenleaf. On file, Record Room, S. G. O., 680.3 (Med. Dept., Camp Greenleaf) C.
- (14) Letter from the commanding officer, Service Company, M. O. T. C., to the commandant, M. O. T. C., Camp Greenleaf, June 2, 1918. Subject: Report of changes and activities of personnel. On file, Record Room, S. G. O., 210 (M. O. T. C., Camp Greenleaf) C.
- (15) Report on division of medical department training, S. G. O., July, 1918, to January, 1919, by Lieut. Col. S. J. Morris, M. C. On file, Record Room, S. G. O., 353 (Training, General).
- (16) Memorandum from the Assistant Chief of Staff to The Adjutant General, November 30, 1918. Subject: Transfer of enlisted men to camps near or within their respective States for discharge. On file, Record Room, S. G. O., 370 (Demobilization, General).
- (17) Annual Report of the Surgeon General of the Army, 1919, Vol. I, 318, 623.
- (18) Letter from the president, general examining board, to the commandant, M. O. T. C., November 2, 1918. Subject: Classification of student officers for October, 1918. On file, Record Room, S. G. O., 210.3 (Camp Greenleaf, Student Officers) C.
- (19) History of Camp Greenleaf, Medical Officers' Training Camp, Fort Oglethorpe, Ga., November, 1917, by Col. Henry Page, M. C. On file, Record Room, S. G. O., 354.6 (Camp Greenleaf) C.
- (20) Report on base and evacuation hospitals, by Maj. H. H. Bailey, M. C. (undated). On file, Record Room, S. G. O., 323.3 (Camp Greenleaf).
- (21) Annual reports of the Surgeon General, U. S. Army, for 1917, 1918, and 1919. Also: History of individual hospital. On file, Historical Division, S. G. O. Also: Letter from Col. Charles Lynch, M. C., to Col. W. N. Bispham, M. C., March 22, 1921. Subject: Inclosing list of base and evacuation hospitals organized at camps during the war. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (22) Report of motor section, Camp Greenleaf, Ga., by Maj. Mahlon Ashford, M. C. (undated). On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (23) Letter from the commanding officer to the commandant, Camp Greenleaf, February 4, 1918. Subject: Report of the command for month of January, 1918. On file, Record Room, S. G. O., 321.6 (Camp Greenleaf) C.
- (24) Current reports of field hospitals and evacuation ambulance companies battalion, Camp Greenleaf Annex, Fort Oglethorpe, Ga. (undated). By First Lieut. H. N. Ervin, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (25) Report on training of motor-ambulance companies for the month of February, 1918, Camp Greenleaf, Ga., by First Lieut. Daniel C. W. Smith, M. R. C., February 26, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (26) Letter from the commanding officer to the Surgeon General, U. S. Army, April 18, 1918. Subject: Motormen required for Medical Department. With first to seventh indorsements, inclusive. On file, Record Room, S. G. O., 221 (Motormen) (M. O. T. C., Fort Oglethorpe) C.
- (27) Schedule "A," headquarters, motor sanitary units, Camp Greenleaf Annex, Chickamauga Park, Ga., May 22, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (28) Schedule "B," headquarters, motor sanitary units, Camp Greenleaf Annex, Chickamauga Park, Ga., June 13, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).

- (29) Schedule "C," replacement and similar units, headquarters, motor units, August 23, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (30) Schedule "D," for reservists, headquarters, motor units, August 23, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (31) Schedule "E," provisional ambulance companies; provisional hospital companies; evacuation ambulance companies; headquarters, motor units, August 23, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (32) Letter from the commanding officer, animal-drawn replacement group, to the commandant, Camp Greenleaf, January 31, 1918. Subject: Report condition of command for month of January, 1918. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (33) Report of animal-drawn group, Camp Greenleaf, February, 1918, by Maj. J. E. Bastion, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (34) Report of ambulance companies, animal drawn, Camp Greenleaf, February, 1918, by Maj. H. B. McIntyre, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (35) Report of animal-drawn group, Camp Greenleaf, May, 1918, by Maj. J. E. Bastion, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (36) Report of replacement group, Camp Greenleaf, August, 1918, by Lieut. Col. J. E. Bastion, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (37) Letter from the Assistant Adjutant to the commandant, Camp Greenleaf, August 1, 1918. Subject: Camp history for July. On file, Record Room, S. G. O., 314.7 (Camp Greenleaf) C.
- (38) Scheme of depot brigade (undated), by First Lieut. George B. Hunt, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (39) Reports of instruction at Camp Greenleaf at units other than the M. O. T. C., by Col. Roger Brooke, M. C. (undated). On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (40) Report: Success of the training camp replacements, by Maj. J. E. Bastion, M. C. (undated). On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (41) Letter from the district orthopedic surgeon to the Surgeon General, U. S. Army, July 16, 1918. Subject: Orthopedic work, Camp Greenleaf. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (42) G. O. No. 45, May 9, 1918.
- (43) Report of replacement group, Camp Greenleaf, September, 1918, by Lieut. Col. J. E. Bastion, M. C. On file, Record Room, S. G. O., 354.6 (Camp Greenleaf).
- (44) Letter from Maj. W. M. Robertson, I. G., to The Adjutant General of the Army. September 11, 1918. Subject: Inspection of Camp Greenleaf, Ga. On file, Record Room, S. G. O., 333 (Camp Greenleaf) C.
- (45) Report for July, 1919, of the 15th Battalion, Camp Greenleaf, by Maj. N. T. Kirk, August 4, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (46) Letter from the director of instructions in orthopedic surgery to the Surgeon General, U. S. Army, August 31, 1918. Subject: Report of activities of School of Orthopedic Surgery for August, 1918. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (47) Letter from Capt. John T. O'Farrall, M. R. C., to Maj. J. Ridlon, M. R. C., director, School of Orthopedic Surgery, August 1, 1918. Subject: Personal teaching activities for July, 1918. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (48) Monthly report, Noncommissioned Officers' School, Camp Greenleaf, Ga., December 31, 1917, by Maj. N. T. Kirk, M. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (49) Report of Noncommissioned Officers' School group, Camp Greenleaf, February, 1918, by Maj. N. R. Kirk, M. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (50) Report of detention camp, Camp Greenleaf, Ga., February, 1918, by Maj. Edward M. Colie, M. R. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).

- (51) Report of 15th Battalion, Camp Greenleaf, Chickamauga Park, Ga., August, 1918, by Maj. N. T. Kirk, M. C. On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (52) General Orders No. 52, headquarters, Camp Greenleaf, Chickamauga Park, Ga., June 3, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (53) Report of 15th Battalion, Camp Greenleaf, Chickamauga Park, Ga., July, 1918, by Maj. N. T. Kirk, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf). Also: Report by Maj. N. T. Kirk, M. C. (undated). Subject: Handling and training recruits. On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (54) Letter from the commanding officer to the commandant, Camp Greenleaf, M. O. T. C., Fort Oglethorpe, Ga., June 1, 1917. Subject: Report of Battalion No. 14 and Service Battalion No. 11. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (55) Letter from the commandant, Camp Greenleaf, Fort Oglethorpe, Ga., to the Surgeon General, U. S. Army, April 8, 1918. Subject: Base and evacuation hospitals. On file, Record Room, S. G. O., 322.3 (General Hospital, Camp Greenleaf) C.
- (56) Report of hospital train group, Camp Greenleaf, Ga., February, 1918, by Lieut. Col. G. H. Scott, M. C. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (57) Letter from the commandant, Camp Greenleaf, Fort Oglethorpe, Ga., to Col. P. M. Ashburn, M. C., January 3, 1918. Subject: Base and evacuation hospitals. On file, Record Room, S. G. O., 322.3 (Misc. M. O. T. C., Camp Greenleaf) C.
- (58) Organization of evacuation hospitals, by Lieut. Col. H. H. Rutherford, M. C. (undated). On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (59) General Orders, No. 1., Headquarters, E. G. group, Camp Greenleaf, Ga., July 24 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (60) Evacuation hospital group, Camp Greenleaf, schedule of instruction for enlisted men, first week, beginning July 29, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (61) Evacuation hospital group, Camp Greenleaf, Ga. Schedule of instruction for officers, first week, beginning July 29, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf).
- (62) Report of Noncommissioned Officers' School, Camp Greenleaf Annex, January, 1918, by Maj. N. T. Kirk, M. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (63) Noncommissioned Officers' School, by Capt. George Walter, M. R. C. instructor. On file, Record Room, S. G. O., 352.4 (Noncommissioned Officers' School).
- (64) Report on Noncommissioned Officers' School, Camp Greenleaf, Chickamauga Park, Ga., May, 1918, by Maj. George Walter, M. R. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (65) Noncommissioned Officers' School, by Maj. H. McNyder, M. C. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (66) Memorandum to the commandant, Camp Greenleaf, Ga., November 7, 1918, from Lieut. Col. Thomas J. Flynn, M. C. Subject: Progress of group for October, 1917. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (67) Letter from the Adjutant to the commanding officer, Noncommissioned Officers' School, November 7, 1918. Subject: Noncommissioned Officers' School. On file, Record Room, S. G. O., 352 (Camp Greenleaf).
- (68) Memorandum from Col. E. L. Munson, M. C., to the Surgeon General, March 2, 1918. Subject: Need for a systematic plan for psychological stimulation of troops in promoting fighting efficiency. On file, Record Room, S. G. O., 250-2 (General Files).
- (69) G. O. No. 57, headquarters, Camp Greenleaf, Chickamauga Park, Ga., June 6, 1918. On file, Record Room, S. G. O., 300.5 (Camp Greenleaf).
- (70) Memorandum to the commandant, Camp Greenleaf, Ga., from First Lieut. Elliott P. Frost, Sanitary Corps, October 1, 1918. Subject: Munson plan of morale work at Camp Greenleaf. On file, Record Room, S. G. O., 250.1-1.

- (71) Memorandum to Major Kirk from Capt. Wm. S. Foster, Sanitary Corps, June 26, 1918. Subject: Weekly report of morale work, Battalion 15. On file, Record Room, S. G. O., 319.1 (Psychological, Camp Greenleaf) C.
- (72) Letter from the senior instructor to the commandant, dated January 5, 1919, signed by Col. Roger Brooke, M. C. Subject: Monthly report of instruction, December, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (73) Circular, W. D., July 16, 1917.
- (74) Scheme of instruction, M. O. T. C., Fort Oglethorpe, Ga. (undated). On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (75) G. O., No. 51, headquarters, Camp Greenleaf, Chickamauga Park, Ga. May 31, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (76) Lectures delivered at Camp Greenleaf, M. O. T. C., Fort Oglethorpe, Ga., September 12, 1917, printed by Camp Greenleaf Publishing Co., Fort Oglethorpe, Ga. On file, Record Room, S. G. O., 700.3.
- (77) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., November 28, 1917. Subject: Condensed schedule of instruction for medical officers under training for line of communications service. On file, Record Room, S. G. O., 353 (M. O. T. C., Fort Oglethorpe) C.
- (78) General Orders No. 58, headquarters, Camp Greenleaf, Chickamauga Park, Ga., June 6, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (79) Letter from the commandant, Medical Officers' Training Camp, Camp Greenleaf, Ga., to Col. P. M. Ashburn, M. C. (undated). Subject: Medical officers. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (80) Letter from the commandant, Medical Officers' Training Camp, Camp Greenleaf, Ga., to Col. E. L. Munson, M. C., June 23, 1917. Subject: Scheme for early training for enlisted men. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (81) Report by Maj. N. T. Kirk, M. C. (undated). Subject: Handling and training of recruits. On file, Record Room, S. G. O., 353 (Camp Greenleaf).
- (82) Tables compiled from classification of draft, based on "Trade specifications and occupational index." On file, Enlisted Section, Personnel Division, S. G. O. (Misc. File).
- (83) Success of the training camp, by Maj. J. E. Bastion, M. C. (undated). On file, Record Room, S. G. O., 322.3 (Camp Greenleaf) C.
- (84) Memorandum to Col. E. L. Munson, M. C., from Col. W. N. Bispham, M. C., September 9, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (85) Letter from the Assistant Adjutant to the commandant, medical officers' training camp, November 1, 1918. Subject: Camp history for the month of October, 1918. On file, Record Room, S. G. O., 314.7 (Medical History, Camp Greenleaf) C.
- (86) Report of the division of Medical Department training, Surgeon General's Office, May and June, 1918, by Col. P. M. Ashburn, M. C. On file, Record Room, S. G. O., 353 (General).
- (87) G. O. No. 54, headquarters, Camp Greenleaf, Chickamauga Park, Ga., June 4, 1918. On file, Record Room, S. G. O., 354.6-1 (General).
- (88) Correspondence concerning School of Hygiene, Camp Greenleaf. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (89) Letter from Col. E. L. Munson, M. C., to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., January 7, 1918. Subject: School of Hygiene. On file, Record Room, S. G. O., 352.4 (School of Hygiene, Camp Greenleaf) C.
- (90) Letter from the senior instructor, to the commandant, Camp Greenleaf, June 10, 1918. Subject: Monthly report of instruction. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf).
- (91) Letter from the director, department of hygiene and sanitation, Camp Greenleaf, Chickamauga Park, Ga., to Col. W. N. Bispham, M. C., January 9, 1919. Subject: Report on the School of Hygiene and Sanitation. On file, Record Room, S. G. O., 353 M. O. T. C., (Camp Greenleaf).
- (92) History of Camp Greenleaf, February, 1918, by Col. Henry Page, M. C. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf, Ga.) C.

- (93) Letter from the camp sanitary officer to the commandant, Camp Greenleaf, November 1, 1918. Subject: Report of the laboratory of field sanitation. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf).
- (94) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., January 7, 1918. Subject: School for Sanitary Engineer Officers of the Sanitary Corps. On file, Record Room, S. G. O., 354.1 (Instruction, Camp Greenleaf) C.
- (95) Letter from Maj. William C. Hood, Sanitary Corps, senior instructor, to Col. Roger Brooke, M. C., senior instructor, Camp Greenleaf, May 10, 1918. Subject: Instructional program in sanitary engineering. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf).
- (96) Letter from Maj. Edward D. Rich, Sanitary Corps, director, School of Sanitary Engineering, to Col. Roger Brooke, M. C., senior instructor, M. O. T. C., Camp Greenleaf, December 26, 1918. Subject: Final report of the School of Sanitary Engineering, covering the months of November and December, 1918. On file, Record Room, S. G. O., 322.3 (Camp Greenleaf) C.
- (97) Memorandum to headquarters, M. O. T. C., Camp Greenleaf, Ga., from Maj. Ellis K. Kerr, M. C., November 3, 1918. On file, Record Room, S. G. O., 354.6 (Camp Greenleaf).
- (98) Letter from Maj. Estes Nichols, M. R. C., to the Surgeon General, U. S. Army, January 31, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (99) Letter from Maj. Estes Nichols, M. R. C., to the commandant, M. O. T. C., March 6 1918. Subject: Camp Greenleaf School of Lung Diseases. On file, Record Room, S. G. O., 353 (School of Lung Diseases, Camp Greenleaf).
- (100) Letter from Maj. Estes Nichols, M. R. C., to Lieut. Col. E. H. Bruns, M. C., April 30, 1918. Subject: Preliminary report of instruction, lung diseases. On file, Record Room, S. G. O., 353 (Cardiovascular, Camp Greenleaf) C.
- (101) Report of the department of cardiovascular instruction, Camp Greenleaf, Chickamauga Park, Ga., March 1, 1918, by Maj. Maurice L. Goodkind, M. R. C., director. On file, Record Room, S. G. O., 353 (Cardiovascular, Camp Greenleaf) C.
- (102) Letter from Maj. Maurice L. Goodkind, M. R. C., to commanding officer, Camp Greenleaf, February 5, 1918. Subject: Cardiovascular department report. On file, Record Room, S. G. O., 353 (Cardiovascular, Camp Greenleaf).
- (103) Letter from Maj. Roy D. Adams, M. R. C., to the Surgeon General, May 17, 1918. Subject: Report of instruction in the School of Internal Medicine. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (104) Letter from Maj. Roy D. Adams, M. R. C., to the Surgeon General, U. S. Army, July 9, 1918. Subject: Instruction in general medicine and gastroenterology, in Camp Greenleaf School of Internal Medicine. On file, Record Room, S. G. O., 353, (Camp Greenleaf) C.
- (105) Letter from Maj. Roy D. Adams, M. C., to the commanding officer, Camp Greenleaf, October 3, 1918. Subject: Report of instruction in School of Military Medicine during the month of September, 1918. On file, Record Room, S. G. O., 353 (Medicine, Camp Greenleaf) C.
- (106) Letter from the senior instructor to the commandant, Camp Greenleaf, January 5, 1919. Subject: Monthly report of instruction, December, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (107) Fifth indorsement, W. D., from The Adjutant General to the Surgeon General, January 19, 1918 (to letter from the Surgeon General, to The Adjutant General, December 7, 1917. Subject: Continuance of psychological work). On file, Record Room, S. G. O., 702.4 (Psychological Exam.) 1917.
- (108) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., June 5, 1918. Subject: School of Military Psychology. On file, Record Room, S. G. O., 352.1 (Psychologists).

- (109) Letter from Capt. William S. Foster, Sanitary Corps, to the Surgeon General, U. S. Army, August 13, 1918. Subject: Report of the School of Military Psychology. On file, Record Room, S. G. O., 353.4 (Psychology, Camp Greenleaf) C.
- (110) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Camp Greenleaf, Fort Oglethorpe, Ga., June 26, 1918. Subject: Tentative syllabus of course in military psychology. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf).
- (111) Letter from the senior instructor in psychology to the Surgeon General (undated). Subject: Report of the School of Military Psychology, Camp Greenleaf, Ga., from August 7, 1918, to January 9, 1919. On file, Record Room, S. G. O., 352 (School of Military Psychology, Camp Greenleaf).
- (112) Letter from the School of Applied Surgical Mechanics to the Surgeon General, U. S. Army, February 28, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 353 (Training, General).
- (113) Correspondence from the S. G. O. to the commandant, M. O. T. C., Camp Greenleaf. On file, Record Room, S. G. O., 353 (Orthopedies). Also: History of Camp Greenleaf, month of February, 1918, by Col. Henry Page, M. C. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf, Ga.) C.
- (114) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., December 6, 1917. Subject: School in Military Orthopedies. On file, Record Room, S. G. O., 352 (Orthopedies, M.O.T.C., Camp Greenleaf) C.
- (115) Letter from Col. Henry Page, M. C., to the Surgeon General, U. S. Army, December 31, 1917. Subject: Report for the month of December, 1917. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Oglethorpe).
- (116) Letter from the director of the School of Orthopedic Surgery to the Surgeon General, U. S. Army, December 24, 1918. Subject: Monthly report of the School of Orthopedic Surgery. On file, Record Room, S. G. O., 353 (Orthopedies, Camp Greenleaf) C.
- (117) Letter from the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., to Maj. E. G. Brackett, M. C., December 11, 1917. Subject: School of Orthopedies. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (118) Letter from Col. Henry Page, M. C., to Maj. E. G. Brackett, M. C., January 3, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf).
- (119) Letter from the orthopedic surgeon, post hospital, to Col. Henry Page, M. C., February 6, 1918. Subject: Course in military orthopedies. On file, Record Room, S. G. O., 353 (Orthopedic Surgery, M. O. T. C. Camp Greenleaf) C.
- (120) Letter from the instructor in clinical orthopedic surgery to the commandant of the medical training camp, March 1, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 353 (Orthopedic Surgery, M. O. T. C., Camp Greenleaf, Ga.) C.
- (121) Letter from the instructor in clinical orthopedic surgery to the commanding officer, M. O. T. C., May 31, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (122) Letter from the director of instruction in orthopedic surgery to the Surgeon General, U. S. Army, July 15, 1918. Subject: Report of July 15, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (123) Letter from Maj. J. T. Rugh, M. R. C., to the Surgeon General, May 12, 1918. Subject: Orthopedic surgery at Fort Oglethorpe and Camp Greenleaf. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (124) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Camp Greenleaf, Ga., July 12, 1918. Subject: Student officers' division of orthopedic surgery. On file, Record Room, S. G. O., 353 (Orthopedies, M. O. T. C., Camp Greenleaf) C.
- (125) Letter from the district orthopedic surgeon to the Surgeon General, U. S. Army, August 26, 1918. Subject: Orthopedic activities at Camp Greenleaf. On file, Record Room, S. G. O., 720 (Orthopedists, M. O. T. C., Camp Greenleaf) C.

- (126) Letter from Maj. Edwin W. Ryerson, M. C., to Col. W. N. Bispham, M. C. (undated). Subject: Instruction in Orthopedic School. On file, Record Room, S. G. O., 353 (Orthopedic surgery, M. O. T. C., Camp Greenleaf, Ga.) C.
- (127) Letter from Capt. E. A. Klein, M. R. C., to Maj. John Ridlon, M. R. C., July 31, 1918. Subject: Report of activities during July, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (128) Letter from the acting director, School of Orthopedic Surgery, to the Surgeon General, U. S. Army, September 30, 1918. Subject: Monthly report, orthopedic teaching activities. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (129) Letter from the director of the School of Orthopedic Surgery to the Surgeon General, U. S. Army, October 31, 1918. Subject: School of Orthopedic Surgery. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (130) Letter from the commandant, Camp Greenleaf, Ga., to Col. P. M. Ashburn, M. C., S. G. O., June 4, 1918. Subject: Courses of instruction. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (131) Letter from the director, School of Military Surgery, to the Surgeon General, U. S. Army, December 24, 1918. Subject: Final report of School of Military Surgery. On file, Record Room, S. G. O., 353.1 (Camp Greenleaf) C.
- (132) Letter from Maj. Edward Martin, M. C., to the Surgeon General, September 11, 1918. Subject: Report of the School of Surgery. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf) C.
- (133) Letter from the director, School of Surgery, to the Surgeon General, U. S. Army, October 4, 1918. Subject: Report of class 2 for September, 1918. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf) C.
- (134) Letter from the director, School of Military Surgery, to the Surgeon General, U. S. Army, November 27, 1918. Subject: Report for November, 1918. On file, Record Room, S. G. O., 353-1 (Surgery, Camp Greenleaf) C.
- (135) Schedules, School of Surgery, M. O. T. C., Camp Greenleaf. On file, Record Room, S. G. O., 353-1 (Surgery, Camp Greenleaf) C.
- (136) Letter from Maj. Karl W. Ney, M. R. C., to the Surgeon General of the Army, May 9, 1918. Subject: Neurosurgical School. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf) C.
- (137) Letter from Maj. Karl W. Ney, M. R. C., to the Surgeon General of the Army, June 28, 1918. Subject: Report of Neurosurgical School. On file, Record Room, S. G. O., 353-1 (Neurosurgery, Camp Greenleaf) C.
- (138) Reorganization of Neurosurgical School at Camp Greenleaf. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf) C.
- (139) Letter from Maj. Claude C. Coleman, M. C., to the Surgeon General, U. S. Army, November 16, 1918. Subject: School of Neurosurgery. On file, Record Room, S. G. O., 353-1 (Neurosurgery, Camp Greenleaf) C.
- (140) Letter from the director, School of Neurosurgery, to the Surgeon General, U. S. Army, November 23, 1918. Subject: School of Neurosurgery. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf) C.
- (141) Letter from the director, School of Neurosurgery, to the Surgeon General, U. S. Army, December 12, 1918. Subject: School of Neurosurgery. On file, Record Room, S. G. O., 353-1 (Neurosurgery, Camp Greenleaf) C.
- (142) Harris, T. J., lieutenant colonel, M. C.: An account of the organization and development of the School of Otolaryngology, Camp Greenleaf, Chickamauga Park, Ga. *Annals of Otolaryngology, Rhinology, and Laryngology*, St. Louis, 1920, xxxix, No. 7, 144.
- (143) Letter from Lieut. Col. T. J. Harris, M. C., to Col. W. N. Bispham, M. C., January 3, 1919. Subject: Outline course of instruction of School of Otolaryngology, Camp Greenleaf, Ga. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf).
- (144) de Schweinitz, G. E., lieutenant colonel, M. C.: Organization and development of the School of Ophthalmology, U. S. General Hospital No. 14, Fort Oglethorpe, Ga. *American Journal of Ophthalmology*, Chicago, 1918, i, No. 12, 817.

- (145) Letter from Maj. Meyer Weiner, M. C., to Col. W. N. Bispham, M. C., commandant, Camp Greenleaf, Ga., January 2, 1919. Subject: Course in ophthalmology. On file, Record Room, S. G. O., 353 (Ophthalmology, Camp Greenleaf).
- (146) Letter from the commanding officer, Camp Greenleaf, Ga., to the Surgeon General of the Army, April 28, 1918. Subject: Director of School of Urology. On file, Record Room, S. G. O., 201 (Gideon Timberlake).
- (147) Letter from the director, School of Urology, Camp Greenleaf, Ga., to the Surgeon General of the Army, May 27, 1918. Subject: Availability of urologists. On file, Record Room, S. G. O., 353 (Urology, Camp Greenleaf) C.
- (148) Letter from Capt. Gideon Timberlake, M. C., to Maj. Warren Walker, M. C., August 31, 1918. Subject: School of Urology. On file, Record Room, S. G. O., 353 (Urology, Camp Greenleaf) C.
- (149) Letter from the director to chief of instruction, Camp Greenleaf, June 7, 1918. Subject: Progress of school. On file, Record Room, S. G. O., 353 (Urology, Camp Greenleaf) C.
- (150) Letter from Capt. Gideon Timberlake, M. C., to the Surgeon General, U. S. Army, April 1, 1918. Subject: Instruction in urology. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (151) Letter from Maj. Gideon Timberlake to Maj. Warren Walker, September 3, 1918. On file, Record Room, S. G. O., 353 (Urology, Camp Greenleaf) C.
- (152) Letter from the director, School of Plastic and Oral Surgery, to the Surgeon General, U. S. Army, December 19, 1918. Subject: Report of second month's work, School of Plastic and Oral Surgery. On file, Record Room, S. G. O., 353 (Oral and Plastic Surgery, Camp Greenleaf) C.
- (153) Letter from the director, School of Plastic and Oral Surgery, Camp Greenleaf, Ga. to the Surgeon General, December 26, 1918. Subject: Activities, School of Plastic and Oral Surgery, December 16-24. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (154) Letter from Maj. W. F. Manges, M. C., to the commandant, Camp Greenleaf, Ga., January 31, 1918. Subject: Monthly report of Camp Greenleaf, School of Roentgenology. On file, Record Room, S. G. O., 352.4 (Roentgenology, Camp Greenleaf) C.
- (155) Letter from the Acting Surgeon General, U. S. Army, to Maj. Willis F. Manges, M. C., Camp Greenleaf, Ga., September 28, 1918. Subject: Memorandum on enlargement of school Roentgenology. On file, Record Room, S. G. O., 353 (Roentgenology, Camp Greenleaf) C.
- (156) Letter from Maj. A. S. Begg, M. R. C., to the Surgeon General, U. S. Army, July 6, 1918. Subject: Proposed School of Anatomy. Also: First indorsement of approval, signed by Col. E. L. Munson, M. C., commandant. On file, Record Room, S. G. O., 353-1 (Camp Greenleaf).
- (157) Letter from the director of the School of Anatomy to the commandant, M. O. T. C., Camp Greenleaf, Ga., December 20, 1918. Subject: Report of work done in the School of Anatomy from the time of its organization to December 16, 1918. On file, Record Room, S. G. O., 353 (School of Anatomy, Camp Greenleaf).
- (158) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., January 19, 1918. Subject: School for training of laboratory specialist officers. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf) C.
- (159) History of Camp Greenleaf, month of February, 1918, by Col. Henry Page, M. C. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Camp Greenleaf, Ga.) C.
- (160) Memorandum for Col. F. F. Russell, M. C., from Col. E. L. Munson, M. C., June 29, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (161) Letter from the chief of the laboratory service to Col. F. F. Russell, M. C., July 2, 1918. Subject: Laboratory instruction. On file, Record Room, S. G. O., 353 (Laboratory Gen. Hosp. No. 14) K, Fort Oglethorpe.

- (162) Memorandum for Col. Henry Page, M. C., commandant, Camp Greenleaf, Ga., January 30, 1918, by Capt. D. H. Bergey, M. R. C. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (163) Laboratory course for student officers, July 2 to July 31, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (164) Laboratory schedule for course of instruction for enlisted men, November 25, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (165) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., March 7, 1918. Subject: School for officers of the division of food and nutrition, Sanitary Corps. On file, Record Room, S. G. O., 353 (Nutrition, Camp Greenleaf) C.
- (166) Memorandum for Maj. John Murlin, chief, division of food and nutrition, March 7, 1918. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (167) Syllabus of instruction, course for nutrition officers at Camp Greenleaf. On file, Record Room, S. G. O., 353 (Nutrition, Camp Greenleaf) C.
- (168) Letter from Capt. R. J. Anderson, Sanitary Corps, to the Surgeon General, U. S. Army, December 16, 1918. Subject: Work in the School of Nutrition. On file, Record Room, S. G. O., 720.1 (Camp Greenleaf) C.
- (169) Letter from Maj. E. B. Forbes, Sanitary Corps, N. A., to the Surgeon General, U. S. Army, June 25, 1918. Subject: Work of party from food division. On file, Record Room, S. G. O., 353 (Nutrition, Camp Greenleaf) C.
- (170) Memorandum to the commandant. Subject: Outline of course for nutrition officers, January 1, 1919. On file, Record Room, 353 (Nutrition, Camp Greenleaf) C.
- (171) Letter from Capt. R. J. Anderson, Sanitary Corps, to the Surgeon General, U. S. Army, November 4, 1918. Subject: Improving the course of instruction for nutrition officers. On file, Record Room, S. G. O., 353 (Nutrition, Camp Greenleaf) C.
- (172) Letter from the Surgeon General, U. S. Army, to the commandant, Medical Officers' Training Camp, Fort Oglethorpe, Ga., February 1, 1918. Subject: School for training officers of the Dental Corps. On file, Record Room, S. G. O., 354.1 (Instruction Dental Corps, Fort Oglethorpe) C.
- (173) Letter from the senior dental instructor, Camp Greenleaf, Ga., to the Surgeon General, U. S. Army, March 6, 1918. Subject: Army Dental School. On file, Record Room, S. G. O., 353 (Course of Instruction for Dental Surgeons, Camp Greenleaf) C.
- (174) Letter from Maj. J. H. Snapp, D. C., to Col. W. N. Bispham, M. C., January 2, 1919. Subject: Instruction in School of Dentistry. On file, Record Room, S. G. O., 353 (School for Dental Surgeons, Camp Greenleaf) C.
- (175) Letter from the commander to the commandant, March 1, 1918. Subject: Report for February of the School for Veterinarians. On file, Record Room, S. G. O., 353 (Veterinary School, Camp Greenleaf) C.
- (176) Letter from Maj. David S. White, V. C., to acting director of veterinary service, April 4, 1918. Subject: Report on instruction given veterinary officers, Camp Greenleaf, Ga., March 6 to 30, 1918. On file, Record Room, S. G. O., 353 (Vet., Camp Greenleaf) C.
- (177) Letter from Maj. Wilfred J. Stokes, V. C., to the commandant, Camp Greenleaf, Chickamauga Park, Ga., January 10, 1919. Subject: Instruction of veterinary student officers. On file, Record Room, S. G. O., 353 (Vet. Camp Greenleaf) C.
- (178) Letter from the Surgeon General to the commandant, Medical Officers' Training Camp, Camp Greenleaf, Fort Oglethorpe, Ga., June 8, 1918. Subject: Veterinary officers in training. On file, Record Room, S. G. O., 353 (Veterinary, Camp Greenleaf) C.
- (179) Letter from the director, School of Gas Defense, to the commanding officer, Camp Greenleaf, December 11, 1918. Subject: Final report of instruction. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (180) Letter from the director, School of Gas Defense, to Col. W. N. Bispham, M. C., January 2, 1918. Subject: Suggestions in gas-defense instruction. On file, Record Room, S. G. O., 353 (School of Gas Defense, Camp Greenleaf) C.

- (181) General Orders No. 65, June 27, 1918, headquarters, Camp Greenleaf, Chickamauga Park, Ga. On file, Record Room, S. G. O., 353 (Adjutants, Mess Officers and Registrars, Camp Greenleaf) C.
- (182) Report of N. C. O., school group, Camp Greenleaf, February, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (183) School for Mess Sergeants and Cooks, by Capt. J. B. Piggott, M. R. C. On file, Record Room, S. G. O., 353.4 (School for Mess Sergeants and Cooks).
- (184) Report of 15th Battalion, Camp Greenleaf, Chickamauga Park, Ga. May 31, 1918, by Maj. N. T. Kirk, M. C. On file, Record Room, S. G. O., 353 (Camp Greenleaf) C.
- (185) G. O. No. 59, headquarters, Camp Greenleaf, June 13, 1918, Chickamauga Park, Ga. On file, Record Room, S. G. O., 353 (General).
- (186) Letter from the commandant to Col. P. M. Ashburn, M. C., June 12, 1918. Subject: School for Cooks and Bakers. On file, Record Room, S. G. O., 352.4 (School for Cooks and Bakers, Camp Greenleaf) C.
- (187) Memorandum for Colonel Bispham, commandant Camp Greenleaf, Ga., October 7, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (188) Letter from the commanding officer to the commandant, Camp Greenleaf, Ga., November 7, 1918. Subject: Report of progress, month of October, 1918. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (189) Memorandum to Col. W. N. Bispham, M. C., from Maj. E. L. Claeren, Q. M. C., January 11, 1919. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (190) Report of School for Motor Mechanics and Drivers, by Capt. George S. Foden, M. R. C., February 28, 1918. On file, Record Room, S. G. O., 352.4 (Camp Greenleaf) C.
- (191) Headquarters, motor sanitary units, Camp Greenleaf Annex, January 28, 1918, by Maj. M. Ashford, M. C. On file, Record Room, S. G. O., 352.4 (Motor School, Camp Greenleaf) C.
- (192) Motor section, Camp Greenleaf, Ga., by Maj. M. Ashford, M. C. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (193) Letter from the group commander, headquarters motor unit, to the commanding officer, division hospital and sanitary trains, Camp Greenleaf, Ga., July 29, 1918. Subject: Scheme for training in this group. On file, Record Room, S. G. O., 353 (M. O. T. C., Camp Greenleaf) C.
- (194) History of the veterinary division, S. G. O., by Lieut. Col. C. F. Morse, M. C. On file, Historical Division, S. G. O.
- (195) Letter from Col. E. L. Munson, M. C., to Lieutenant Colonel Snapp, Dental School, June 28, 1918 (no subject given). On file, Record Room, S. G. O., 353 (Dental Assistants, Camp Greenleaf) C.
- (196) Letter from Maj. Harold D. Corbusier, M. R. C., to the senior instructor, Camp Greenleaf, May 2, 1918. Subject: Monthly report, School of Orthopedics. On file, Record Room, S. G. O., 353 (Orthopedics, Camp Greenleaf) C.
- (197) Letter from Maj. Harold D. Corbusier, M. R. C., to the senior instructor, Camp Greenleaf, June 4, 1918. Subject: Monthly report, School of Orthopedics. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (198) Letter from Maj. Alexander S. Begg, M. R. C., to the Surgeon General, July 9, 1918. Subject: Orthopedic conditions, Camp Greenleaf, Ga. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) D.
- (199) Letter from the director of instruction in orthopedic surgery to the Surgeon General, July 15, 1918. Subject: Report of July 15, 1918. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (200) Letter from Capt. John R. O'Ferrall, M. C., to Maj. John Ridlon, M. C., August 31, 1918. Subject: Teaching activities for month of August. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.
- (201) Letter from the acting director, School of Orthopedic Surgery, to the Surgeon General, September 30, 1918. Subject: Monthly report, orthopedic teaching activities. On file, Record Room, S. G. O., 730 (Orthopedics, Camp Greenleaf) C.

- (202) Letter from Capt. Wm. J. Merrille, M. C., to the director of the School of Orthopedic Surgery, September 30, 1918. Subject: Report of teaching and other activities for month of September, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (203) Letter from Capt. Elmer A. Klein, M. C., to the director of the School of Orthopedic Surgery, October 31, 1918. Subject: Report of activities during October, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (204) Letter from Capt. Wm. J. Merrille, M. C., to the director of the School of Orthopedic Surgery, October 31, 1918. Subject: Report of teaching activities, October, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (205) Letter from Capt. J. T. O'Ferrall, M. C., to Maj. Edwin W. Ryerson, M. C., October 31, 1918. Subject: Personal teaching activities, month of October, 1918. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (206) Letter from the School of Orthopedic Surgery, to the Surgeon General, November 30, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 730 (Orthopedies, Camp Greenleaf) C.
- (207) Letter from the director of the School of Orthopedic Surgery to the Surgeon General, December 24, 1918. Subject: Monthly report for the School of Orthopedic Surgery. On file, Record Room, S. G. O., 353 (Orthopedies, Camp Greenleaf) C.
- (208) Letter from commandant, Medical Officers' Training Camp, Fort Riley, Kans., to Surgeon General of the Army, December 19, 1917. Subject: Report of the Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley) C.
- (209) Report on the general course of instruction for officers (undated), by Col. W. N. Bispham, M. C. On file, Record Room, S. G. O., 352 (M. O. T. C., Fort Riley) C.
- (210) Report of the division of medical department training, S. G. O., April 6, 1917, to May 10, 1918, by E. L. Munson, colonel, M. C. On file, Record Room, S. G. O., 353 (Training, General).
- (211) Yearbook, Fort Riley, Kans., written by Board of Editors, published by Union Bank. Note Co., Kansas City, Mo., 1918, 137. On file, Historical Division, S. G. O.
- (212) Letter from commandant (W. N. Bispham, lieutenant colonel, M. C.) medical officers' training camp, to Surgeon General of the Army, January 15, 1918. Subject: Report of Medical Officers' Training Camp, Fort Riley, for November. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley).
- (213) History of individual hospital. On file, Historical Division, S. G. O.
- (214) Report for December, 1917, from commandant, Medical Officers' Training Camp, Fort Riley, Kans., to Surgeon General of the Army. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (215) Report for January, 1918, from commandant, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 319.1 (M. O. T. C., Fort Riley): 354.6 (M. O. T. C., Fort Riley) C.
- (216) Report for February, 1918, from commandant, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General. On file, Record Room, S. G. O., 353 (M. O. T. C., Fort Riley) C.
- (217) Report for March, 1918, from commandant, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley) C.
- (218) Report for the month of April, 1918, from the commandant, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General of the Army. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley).
- (219) Report for the month of May, 1918, from the commandant, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General of the Army. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (220) Report for the month of June, 1918, from commandant, Medical Officers' Training Camp, Fort Riley, to Surgeon General of the Army. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley).

- (221) Third indorsement from The Adjutant General to the Surgeon General, June 4, 1918. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley) C.
- (222) Letter from P. M. Ashburn, colonel, M. C., to Col. E. L. Munson, M. C., June 26, 1918. Subject: Output of medical officers' training camps from the beginning of the war to June 1, 1918. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley).
- (223) Report of the general course of instruction for officers at Medical Officers' Training Camp, Fort Riley, Kans., from the commandant to the Surgeon General of the Army (undated). On file, Record Room, S. G. O., 352.11 (M. O. T. C., Fort Riley).
- (224) Syllabus of instruction conducted at Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 353.1 (M. O. T. C., Fort Riley, Kansas).
- (225) Letter from the commandant, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General of the Army, May 12, 1918. Subject: Weekly schedules. On file, Record Room, S. G. O., 353 (M. O. T. C., Fort Riley) C.
- (226) Letter from the Surgeon General of the Army, to the commandant Medical Officers' Training Camp, Fort Riley, Kans., December 6, 1918. Subject: School in Military Röntgenology. On file, Record Room, S. G. O., 353 (Military Röntgenology, M. O. T. C., Fort Riley, Kansas).
- (227) Letter from the Surgeon General of the Army to the commandant, Medical Officers' Training Camp, Fort Riley, Kans., December 7, 1917. Subject: School in Military Orthopedics. On file, Record Room, S. G. O., 353 (Military Orthopedics, M. O. T. C., Fort Riley, Kansas).
- (228) Letter from Maj. Arial W. George, M. R. C., to Col. W. N. Bispham, M. C., commandant, Medical Officers' Training Camp, Fort Riley, February 19, 1918. Subject: Report of section in Röntgenology. On file, Record Room, S. G. O., 353 (Military Röntgenology, M. O. T. C., Fort Riley, Kans).
- (229) Letter from Maj. Arial W. George, M. R. C., to Col. W. N. Bispham, M. C., March 4, 1918. Subject: Report of section in Röntgenology M. O. T. C. On file, Record Room, S. G. O., 353 (Military Röntgenology, M. O. T. C., Fort Riley, Kans.).
- (230) Schedule of instruction, Medical Officers' Training Camp, Fort Riley, Kans., week ending March 16, 1918. On file, Record Room, S. G. O., 353.1 (M. O. T. C., Fort Riley, Kansas).
- (231) Letter from Maj. J. P. Lord, M. R. C., chief instructor military orthopedics, Medical Officers' Training Camp, Fort Riley, to the Surgeon General of the Army, March 1, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 353 (Military Orthopedics, M. O. T. C., Fort Riley, Kansas).
- (232) Letter from Maj. J. P. Lord, M. R. C., to the Surgeon General of the Army, April 1, 1918. Subject: Monthly report, military orthopedics, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (233) Letter from Maj. J. P. Lord, M. R. C., to commanding officer, April 30, 1918. Subject: Monthly report, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (234) Letter from Maj. Charles Spencer Williamson, M. R. C., to the Surgeon General, U. S. Army, June 4, 1918. Subject: Report of the department of hygiene and sanitation, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (235) Shewbrooks, Daniel M., major, M. C.: A laboratory of experimental sanitation at the M. O. T. C., Fort Riley, Kans. *The Military Surgeon*, Washington, D. C., 1918, xlii, No. 2, 179.
- (236) Letter from the director of the sanitary laboratory, Medical Officers' Training Camp, Fort Riley, Kans, to the Surgeon General of the Army, February 1, 1918. Subject: Monthly report of department. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).

- (237) Letter from the director of the sanitary laboratory, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General of the Army, March 1, 1918. Subject: Monthly report of department. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (238) Notes on sanitary appliances, war plans division, April, 1919, War Department, Document No. 897. Office of The Adjutant General, Government Printing Office, 1919.
- (239) Letter from Ellis K. Kerr to the commandant, Medical Officers' Training Camp, Fort Riley, Kans., January, 1918. Subject: Report of department of inspection of communicable diseases. On file, Record Room, S. G. O., 353 (General).
- (240) Report from the senior instructor, contagious diseases, Medical Officers' Training Camp, Fort Riley, Kans., to the commandant (undated). On file, Record Room, S. G. O., 353 (General).
- (241) Outline for examination of lungs for tuberculosis, Fort Riley, Kans. On file, Record Room, S. G. O., 353 (Tuberculosis, M. O. T. C., Fort Riley, Kansas) C.
- (242) Letter from Ralph E. Morris, contract surgeon, U. S. Army, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General, February 11, 1918. Subject: Cardiovascular instruction at M. O. T. C., Fort Riley, Kans. (inclosing synopsis of two lectures). On file, Record Room, S. G. O., 354.6 (M. O. T. C.).
- (243) Report of instruction and assignment of recruits, Fort Riley, Kans., undated, by Maj. H. B. Pillsbury, M. C. On file, Record Room, S. G. O., 354.6 (M. O. T. C.).
- (244) Letter from Lieut. Don S. Numbers, physical instructor, Medical Officers' Training Camp, Fort Riley, Kans., to commandant, February 28, 1918. Subject: Monthly report, physical classes, Medical Officers' Training Camp, Fort Riley. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (245) Letter from Lieut. Don S. Numbers, M. R. C., physical instructor, to the commandant, Medical Officers' Training Camp, Fort Riley, Kans., April 1, 1918. Subject: Report, physical instruction, month of March, 1918. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (246) Letter from Lieut. Don S. Numbers, M. R. C., physical instructor, to commandant, Medical Officers' Training Camp, Fort Riley, Kans., April 30, 1918. Subject: Report, physical class, month of April, 1918. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (247) Letter from Maj. Charles Spencer Williamson, M. R. C., director of the sanitary laboratory, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General of the Army, April 1, 1918. Subject: Monthly report of department. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (248) Letter from Maj. Arial W. George, M. R. C., to Col. W. N. Bispham, M. C., commandant, M. O. T. C., Fort Riley, Kans., June 1, 1918. Subject: Report of section in Röntgenology. On file, Record Room, S. G. O., 353 (Röntgenology, M. O. T. C., Fort Riley, Kansas).
- (249) Letter from Maj. Arial W. George, M. R. C., to Col. W. N. Bispham, M. C., commandant, M. O. T. C., Fort Riley, Kans., April 4, 1918. Subject: Report of section in Röntgenology, M. O. T. C. On file, Record Room, S. G. O., 353 (Röntgenology, M. O. T. C., Fort Riley, Kansas).
- (250) Letter from the director of field hospital companies, Medical Officers' Training Camp, Fort Riley, Kans., to the commandant, March 4, 1918. Subject: Monthly report. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Riley, Kansas).
- (251) Letter from Capt. Robert J. Foster, V. C., to the Surgeon General of the Army, March 16, 1918. Subject: Training, veterinary section, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., 353.1 (Veterinary, Fort Riley).
- (252) Letter from Capt. Robert J. Foster, V. C., to the director, Veterinary Corps, April 20, 1918. Subject: Weekly report, veterinary section, Medical Officers' Training Camp, Fort Riley, Kans. On file, Record Room, S. G. O., (M. O. T. C., Fort Riley) C.

- (253) Letter from the commanding officer, veterinary section, Medical Officers' Training Camp, Fort Riley, to the Surgeon General's Office, May 26, 1918. Subject: Weekly report. On file, Record Room, S. G. O., 353.1 (M. O. T. C., Fort Riley, Kansas).
- (254) Letter from the commanding officer, veterinary section, Medical Officers' Training Camp, Fort Riley, Kans., to the Surgeon General's Office, September 15, 1918. Subject: Weekly report. On file, Record Room, S. G. O., 353.1 (M. O. T. C., Fort Riley).
- (255) S. O. No. 116, W. D., par. 68, May 19, 1917 (detailing Col. P. M. Ashburn, M. C., as commanding officer, M. O. T. C., Fort Benjamin Harrison, Ind.).
- (256) Special Regulations, W. D., 49a, 1917.
- (257) Letter from the Surgeon General to the commandant, Medical Officers' Training Camp, Fort Des Moines, Iowa, July 14, 1917. Subject: Nature and scope of instruction to be given at training camp, Fort Des Moines. On file, Record Room, S. G. O., 354.6 (M. O. T. C., Fort Des Moines, Iowa).

CHAPTER III

MOBILIZATION AND TRAINING CAMP FOR MEDICAL DEPARTMENT UNITS

CAMP CRANE, ALLENTOWN, PA.*

ORGANIZATION

Camp Crane was established in May, 1917, primarily to afford a mobilization place for recruits for the United States Army Ambulance Service, the recruiting center for which was located in Philadelphia; later it was used for the mobilization of Medical Department units of all kinds.

The officers who had been detailed to develop this service¹ were ordered to Philadelphia and were directed to recommend a site in the vicinity of that city for a mobilization camp. They were instructed to secure a camp site which afforded as much shelter already constructed as possible, as military necessity required the War Department to conserve the limited amount of canvas on hand, and it had no funds, at the time, available for the construction of buildings. The grounds of the Lehigh County Agricultural Society, at Allentown, which had a dozen or more permanent buildings of construction more substantial than is usually found on fair grounds, and which were easily accessible for troops and supplies, were secured for the purpose, and were formally turned over to the Government on June 1, 1917.

All of the buildings and some of the stables and sheds that had been used for fancy stock, were utilized for shelter for the men, and later additional space was provided by the erection of frames over which tarpaulins were stretched. The most useful building on the grounds was the grand stand which was modern in every particular, constructed of brick over a heavy steel frame. It seated 10,000 people. In one end of the building were spacious offices, an express office, telegraph office, and a small jail room. The greater part of the space under the grand stand seats was occupied by restaurant facilities, consisting of a dining room, which seated over 2,500 people, with large kitchens at either end, each equipped with eight gas ranges and some large cooking utensils, such as are usually found in hotels. The building also had large lavatories in which there were over 100 modern flush closets. Seats were torn out of the greater part of the grandstand and it then afforded the preferred assignments as section quarters.

The space inside the half-mile elliptical race track was utilized for parking cars and for the garage, while the track afforded space for practice in driving cars. All of the larger buildings were equipped with running water and with electric lights.

* Unless otherwise indicated, the facts herein given are based on: History of United States Army Ambulance Service. History of Camp Crane, Allentown, Pa., by Lieut. Col. E. E. Persons, M. C. Copy on file, Historical Division, S. G. O.

As soon as practicable the Government erected 12 two-story barrack buildings of the standard type adopted for cantonments, a camp infirmary, and 2 buildings for officers' quarters. A year later 4 more barrack buildings were erected. The Young Men's Christian Association built a small "hut," the Young Women's Christian Association a "hostess house," and the Knights of Columbus a house for recreation purposes.

A central steam heating plant, with a battery of three large boilers was installed, at a cost of about \$125,000, to heat all the occupied buildings except the officers' quarters, in which a small heating plant was included. One of the largest and best of the permanent buildings was fitted up as a machine shop and garage, and as soon as the congestion in the camp was relieved by the completion of the new barracks, the largest of the fair ground exhibition buildings was turned over to the entertainment committee for amusement purposes.

Early in July several of the best noncommissioned officers of the Medical Department of the Regular Army were detailed to the camp, assistant quartermasters were assigned, clothing and supplies began to arrive, individual mess kits were issued, and the camp settled down to a comparatively normal routine.

UNITED STATES ARMY AMBULANCE SERVICE

ORGANIZATION

The United States Army Ambulance Service was unique in the history of military organizations of our Government. It was the only unit ever assembled by the Government which was intended primarily for use as a part of a foreign army, organized and equipped in a manner indicated by another nation.

When the United States declared war, the several European powers then at war with Germany sent delegations to the United States for consultation concerning the conduct of the war. Before it had been determined that America should make immediate preparations to send troops to Europe, a conference was held in Washington between the representatives of our War Department and the French High Commission, led by Marshal Joffre, with a view to determining how the United States could best aid France in her prosecution of the war. At this conference, Marshal Joffre asked, among other things, that arrangements be made to furnish France with some ambulance service; and at the request of the American representatives at the conference, he outlined the organization and equipment of the French ambulance sections, a plan of organization which he considered best adapted for the ambulance work desired. To comply with this request of the French Government, it was directed that the United States Army Ambulance Service be organized as follows:²

II. (1) Under authority conferred by section 2 of the act of Congress "authorizing the President to increase temporarily the Military Establishment of the United States," approved May 18, 1917, the President directs that there be organized for the existing emergency, the enlisted strength being raised and maintained by voluntary enlistment or draft, as a part of the Medical Department, the United States Army Ambulance Service, consisting of the following personnel:

Commissioned: Colonel 1; lieutenant colonels, 2; majors, 8; captains, 32; first lieutenants, 160; total, 203.

Enlisted: 168 ambulance sections, each consisting of: Sergeants, first class, 1; sergeants, 2; corporals, 1; mechanics, 2; cooks, 2; privates, first class, 26; privates, 11; total, 45.

(2) The following transportation is authorized for each section: Motor ambulances, 20; motor truck (2-ton), 1; motor truck ($\frac{3}{4}$ -ton), 1; motor car (5-passenger), 1; motor cycle (with side car), 1.

* * * * * *

This was amended later as follows:³

1. Paragraph 1, Section II, General Orders, No. 75, War Department, 1917, organizing the United States Army Ambulance Service as a part of the Medical Department, is amended so as to provide for a total of 34 captains, 169 first lieutenants, and 169 ambulance sections.

The orders quoted above were based on the general plan that one of the sections would be assigned to a division of the French Army; that for each 5 of the sections a repair shop and general supply depot would be established in command of a captain; that for each group of 20 sections an inspector with the grade of major would be provided, and that the higher administrative work of the service would be conducted by 2 lieutenant colonels and 1 colonel. This general scheme, like many other preconceived plans for the operation of American troops abroad, was ultimately modified beyond recognition. The senior officers of the organization, with a few sections, went to Italy for duty with the Italian Army, while the larger number of sections in France operated under the command of an officer commissioned in the Medical Corps and not in the Ambulance Service.

Plans for securing personnel and equipment were begun several weeks before the first order above quoted was promulgated by the War Department. An officer of the Regular Army at the time inspector-instructor, sanitary troops, Pennsylvania National Guard, was directed to begin recruiting for the ambulance service in Philadelphia. Applicants were enlisted in the Medical Enlisted Reserve Corps. Two experienced officers of the Medical Corps were ordered to Philadelphia to take charge of the recruits for this service. The headquarters and chief recruiting center for the organization was temporarily located in Cooper Battalion Hall, at Twenty-third and Christian Streets, Philadelphia, a building placed at the disposal of the Government for the purpose by the Episcopal Church of the Holy Apostles. Here members of the Medical Enlisted Reserve Corps were first inducted into active service on May 22, 1917.

The rumor spread rapidly that an ambulance service would probably be among the first organizations to be sent abroad, and applications for enlistments by men who were impatient to get overseas immediately were received from all parts of the United States. Colleges asked to be permitted to form complete sections of their own men, and the War Department granted their request, making the organization unique in this particular. Over 40 colleges and universities furnished one or more sections of 55 men, who were sent to Camp Crane in charge of one of the party who had been selected as leader. In addition to the men recruited at the Ambulance Service recruiting station at Philadelphia, and the large number of men enlisted at the colleges and universities, a considerable portion of the personnel was derived from the American Red Cross ambulance companies, which desired immediate service. A number of cities and a few industrial corporations contributed complete sections to the service, and a very considerable number of men came from Army recruiting stations throughout

the country which were authorized to send applicants for this service to Camp Crane. Volunteer enlistments furnished personnel for all the sections of the Ambulance Service except a few which were organized just before the armistice from drafted men, and the enlisted personnel of the service as a whole was of a very high grade. With the exception of one or two instances, all enlistments were made in the grade of private, and promotions were made on the basis of ability demonstrated after arrival at camp.

MOBILIZATION AND EQUIPMENT

Headquarters of the Ambulance Service moved from Philadelphia to Camp Crane on June 9, 1917. The first organization to arrive was the Red Cross ambulance company from Washington, D. C. When Allentown had been definitely decided upon as the site for the mobilization camp of the Ambulance Service, 3 carloads of supplies, including blankets, cots, galvanized-iron cans, tools, etc., were sent there at once under convoy of a soldier from the Quartermaster Department depot in Philadelphia. Detachments of students who had been impatiently waiting at their colleges for the announcement of the location of the camp began to pour into the camp before clothing and individual mess equipment were available. Soon after the camp was opened the number of men who reported exceeded its capacity, and from the middle of July until the 1st of December, 1917, it was necessary to keep some organizations out on practice marches constantly to relieve the congestion. No organization retained its quarters in camp while on a practice march.

The commander of the camp and of the Ambulance Service took charge of general administration and procurement of camp supplies. The personnel for entire sections was furnished by individual colleges, cities, and in some instances by corporations. These groups of men usually arrived in charge of some man whose capacity for leadership and whose enthusiasm had placed him at the head of the party. On arrival at camp this man was usually designated as acting sergeant, first class, and he assisted in selecting the other non-commissioned officers for the section. Each section was required to furnish two cooks and one man for dining-room service in the mess. Sometimes two men were found in the section who confessed to having had some meager experience in cooking, and they were detailed as cooks; but as a rule two men had to be selected at random and designated as cooks. The section mechanics were selected in the same way.

Ordnance for equipping the individual soldier, including mess kits, web belts, and other accessories were among the last articles received at the camp. The difficulties encountered in securing clothing and other personal equipment were due to inability of the depots to get the required goods and to delays in transportation.

The organizational equipment was obtained without delay. As soon as it was definitely determined what the unit equipment was to be, the necessary orders for motor equipment for 120 sections were placed.

The French High Commission was insistent in its recommendations that Ford ambulances, touring cars, and light trucks be used, based on their experience during the first two years of the war. It was stated that the lightness of

the car, its durability, and the ease with which parts could be interchanged gave it great superiority for the work to be performed. Orders were therefore placed for approximately 2,400 Ford ambulances, 120 Ford trucks, and 120 Ford touring cars, 120 Packard trucks, and 120 motor cycles with side cars, with an allowance for replacement and a fair allowance of spare parts. By special effort on the part of the manufacturers, early delivery was secured. This large bulk of motor equipment arrived at the seaboard before cargo space was at a premium, was immediately sent across, and landed at St. Nazaire to await the personnel for which it was intended. Later, reports came from France that the spare parts which were urgently needed had not arrived with the shipment of cars, and the matter was investigated here, but it was finally found that the parts had been shipped but had been abstracted by the Quartermaster Department and used for their cars needing repairs.

INSTRUCTION

The purpose and scope of the activities of this camp are set forth in the following communication:⁴

1. These instructions are intended to coordinate the work at the various medical camps of instruction so that it will be carried out on common lines.

Also that the instruction given at these camps, and that which it is proposed to give the medical personnel necessarily serving with troops to meet their needs in the field and at posts, shall have similar basis and method.

To the end that the instruction to be given, and the results to be secured, shall be standardized, the general provisions of this letter will be carried out. You are authorized to modify the general outline of instruction given in paragraph 14, to meet limitations imposed by time and the technical nature of the ambulance service. All details of execution are left to you and you are held responsible for proper results.

2. The course is intended to give student officers a general idea of the basic duties of a medical officer and prepare them for service with troops in the field.

Training will be intensive and pushed as rapidly as possible. It will be borne in mind that the services of thousands of instructed medical officers must be available at an early date. Also that your officers, though now assigned to ambulance work, may be detailed to duty with troops or hospitals and should be grounded in the duties pertaining thereto.

3. The training to be given is intended to prepare these officers to conduct the service of the Medical Department without either the supervision of experienced medical officers or the aid of well qualified noncommissioned officers. The limited number of these two renders it probable that few, if any, will be available for regimental duty, or with ambulance companies and field hospitals.

For this reason, also, upon the reserve medical officers will fall the duty of themselves drilling and training the very many thousands of enlisted raw recruits which will be assigned to the Medical Department, and they must be put into a condition to carry out effectively this most important work.

4. Student officers will be assigned to sanitary units, and receive advanced systematic instruction coincident with the more elementary instruction they will be expected to give to their subordinates.

5. You will make such assignments to instruction duty as you deem best, making due effort to assign to each subject officers known to you to have given special attention thereto and to possess ability to impart information.

You are authorized to use as instructors any student officers found specially qualified in any subject, and to give them special authority while serving, irrespective of rank.

6. Instruction by lectures, except in special subjects, will, as far as possible, give place to recitations. Lectures are not considered as effective as recitations in imparting detailed

information, nor do they afford opportunity to test the capacity and grade the student. Further, your personnel of trained officers is not large enough to cover all subjects by lectures.

Lessons will, therefore, be assigned in the authorized textbooks, and quizzes held thereon, for the purpose of grounding them in theory and insuring that a competent knowledge of methods and principles has been acquired.

7. Coincident with this theoretical instruction, the student officers should as far as possible be made to visualize the organizations, apparatus, and methods concerned. In addition to study and lectures, it is most important that they should learn by seeing and doing. So far as possible, instruction will be made practical.

To this end, for example, specimens of all sanitary appliances and methods likely to be of use in field work will be procured or constructed and continually kept in effective operation at the camp, and the officers will be shown their purpose and practical use.

Bombproofs for trench warfare and gas chambers for practical trial of protection against poison gases will be constructed.

In connection with paper work, all papers required by the medical and other departments will be actually made out until familiarity therewith and correctness of result is secured.

Mess management, taught in theory, will be actually demonstrated in the organization kitchens. Applied camp sanitation will be taught by sanitary inspections. Drill will be taught until every officer can himself effectively handle and instruct therein the units and detachments of the Medical Department.

The internal economy and administration of regimental detachments, ambulance companies, and field hospitals will be thoroughly taught.

8. The training course will be divided into three periods. The first, while instructing the officer as such, is intended especially to familiarize him with the duties of his enlisted subordinates whom he must shortly train. The second takes up his training in his own special functions as an officer. The third carries on and completes the work of the second period.

Now, training classes should as far as possible be started at the conclusion of each month's training period. However, to meet immediate needs, officers needing training will be organized at once into groups for instruction.

9. The following textbooks are authorized for the course of instruction: Army Regulations; Manual for the Medical Department; Field Service Regulations; Drill Regulations for Sanitary Troops; Manual for Courts-Martial; Army cook books.

These books will be invoiced to you without requisition. You will issue one copy of each to each student officer, who will take them with him when he leaves camp for duty elsewhere for reference and use in training his subordinates.

Maps and war-game sets will be sent out on requisition.

You will procure maps of the maneuver grounds in the vicinity of your camp from the commanding general of your department. One map should be available to each student officer.

10. The following school textbooks will be sent you without requisition. They are for use in your training work and will not be taken away by officers.

Field Physical Training of the Soldier, Koehler. (Special Regulations No. 23.)

Manual of Physical Training, Koehler.

Technical Military Dictionary (English-French and French-English), Willcox.

Manual for Noncommissioned Officers and Privates of Infantry, 1917.

Handbook for Sanitary Troops, Mason.

Medical Service in Campaign, Straub.

Elements of Military Hygiene, Ashburn.

Principles of Sanitary Tactics, Munson.

Military Hygiene, Havard.

Sanitation in War, Lelean.

Gunshot Injuries, LaGarde.

Military Surgery, Penhallow.

Surgery in War, Hull.

Also Merton's life-size first-aid charts.

In addition, a miscellaneous assortment of reprints, bulletins, etc., will be sent you for reference and distribution; also a series of current medical publications.

11. The daily instruction, except Saturday afternoon and Sunday, should approximate seven and one-half hours daily.

It is left to the commandant of each medical officers' training camp to prepare schedules for the hours available in each period of instruction among the subjects and time therefor required. This will enable the meeting of the needs of emergency, stormy weather, etc. Copies of the detailed schedules so prepared by you will be furnished this office as soon as practicable.

12. The following general scheme is suggested as a daily schedule:

6 a. m.-----	Reveille.	11.30 to 12.55---	Dinner, rest, etc.
6.15 to 6.30-----	Setting up.	1 to 1.55 p. m---	Quiz or lecture.
6.35 to 7.25-----	Breakfast; police of quar-	2 to 2.55 -----	Quiz or lecture.
	ters.	3 to 4.25-----	Drill.
7.30 to 8.25-----	Drill (marching).	4.30 to 5.55-----	Care of transportation,
8.30 to 9.25-----	Drill (special).		supper, rest, etc.
9.30 to 10.25----	Quiz or lecture.	6-----	Retreat.
10.30 to 11.25---	Quiz or lecture.		

13. On this general plan, 180 hours of formal instruction will be given monthly. No evening exercises are contemplated. Time will be needed for study. Saturday afternoon should be a rest period. Officers should be encouraged in ambulance work on Sunday.

14. The following scheme shows the proposed scope of training of medical officers during the first period: ^b

* * * * * *

15. To stimulate student officers to their best work, a certain number of places in the grade of captain and major, Medical Department Officers' Reserve Corps, will be left unfilled. Appointment will be made to those vacancies from among the student medical officers who, on vote of your staff of instructors, are recommended by you as possessing such exceptional knowledge, aptitude, and efficiency as would qualify them for such increased rank.

To this end you will establish and maintain a graded system of marking, by which relative efficiency will be recorded.

16. Also medical officers satisfying the age and other requirements and after passing such examination as the Surgeon General may require, may, on your recommendation, and subject to the vote of your staff of instructors, be commissioned at once as first lieutenants in the Medical Corps of the Army.

17. If any reserve officer is found unfit for the service by reason of physical, mental, moral, or temperamental reasons, you will, on vote of your staff of instructors, recommend him to this office for separation from the service.

18. In conjunction with the above training plan for medical officers, it is desired to establish a training scheme for enlisted men of the Medical Department. As soon as possible you will prepare a tentative plan for the training of these men in conjunction with that for medical officers and forward it to this office for consideration.

Course for enlisted men should be based on a six weeks' period.

19. You will also prepare and submit a plan for the instruction of selected privates with a view to their promotion as nonecommissioned officers.

It is proposed to appoint men who, after satisfactorily finishing the basic course for enlisted men and the additional course for candidates as sergeants, are reported by you as qualified for such promotion.

20. Receipt of this letter will be acknowledged.

By order of the Surgeon General.

Colonel, Medical Corps, United States Army.

A schedule of instruction, based on the general scheme for instruction published by the Surgeon General for use at medical officers' training camps,⁵ was put in operation, with modifications suitable for the needs of the camp.

^b See pp. 78, 79.

The purpose which dominated the activities of the camp was the development, training, and equipment of an organization for active service overseas in as short a time as possible. The greatest asset in the accomplishment of this task was the eagerness of the personnel to assist in the organization and to receive the training; the greatest handicap in the accomplishment of the task was the lack of instructors. At the beginning, Medical Reserve Corps officers were assigned to command sections. As a rule, they were exceptionally high-grade men, who entered enthusiastically into the work. They were gradually replaced, however, by men promoted from the ranks and given commissions in the Ambulance Service, so that when the armistice was signed there were few medical officers on duty with the service, and most of the commissions in the Ambulance Service were held by men who had entered the service as privates. The policy underlying the instruction was that the instructor must know thoroughly and be able to do what he was trying to teach. Mornings were devoted to strictly military instruction and afternoons to special instruction, drawing of clothing and equipment, fatigue, etc.

Automobile mechanics and others familiar with the Ford motor were assigned to duty at the garage as instructors. With the equipment available it was found impracticable to instruct more than 500 men at one time at the garage. Five men from each section were therefore detailed to the garage each afternoon, and as soon as a man showed that he was proficient he was given a "qualification card" and returned to his section and another man was sent to the garage in his place. Though it was confidently believed that most men in training during the early days of the camp would be motor drivers, they were all given instruction in the Drill Regulations for Sanitary Troops, on the principle that every enlisted man in the Medical Department should become familiar with this manual. As a matter of fact, hundreds of these men were later detached and sent to organizations where this knowledge was vital to their efficiency.

In July four additional officers of the Regular Army Medical Corps were assigned to the camp as instructors and about 100 Medical Reserve Corps officers reported, and were all assigned to some duty in connection with the routine activities of the camp, most of them being placed in command of Ambulance Service sections.

Throughout the greater part of the period from the organization of the camp to the middle of October, 1917, about half of the command was kept on practice marches of a week to one month through the surrounding country.⁵ This was not only for purposes of training, but because of the congested condition of the camp. It was found that a new scheme must be provided even for those left in camp, as under the schedule then in force all elements of the command pursued the same work at the same hours daily. This caused extreme crowding of the available drill grounds, so on October 15 a new schedule, providing for rotation of the various battalions on the drill grounds and in classroom, was put into effect. This provided instruction for two-thirds of the battalions, while the other third was kept on practice marches. For severe weather, when it might be necessary to discontinue practice marches, the schedule provided for handling all battalions in camp after November 11, 1917.

The results of the instruction given were very good, on the whole.⁶ The congestion of the camp, the hurried preparation for and constant expectation of overseas service, the constant replacement of medical reserve officers by newly commissioned nonprofessional officers of the Army Ambulance Service, and the lack of a sufficient number of experienced officers served as handicaps of the work. This was compensated for to some extent, however, by the experience gained by every officer on duty in the camp in handling men in camp and on the march, and in managing the administrative details of an individual organization.

UNITS SENT OVERSEAS

In July, 1917, a senior colonel of the Medical Corps was designated as chief, United States Army Ambulance Service, and accredited to the French Government to arrange the details for the operation of the service and for the enlistment of the personnel of the ambulance sections of the American field service and of the American Red Cross. He visited Camp Crane before sailing for Europe, and it was arranged that 20 sections, for which complete equipment had been secured, should follow him to France, as soon as ocean transportation was available. The dispatch of these 20 sections was accomplished early in August, 1917.

In the meantime, our Government had decided to put an army in Europe as rapidly as possible, and the priority list for shipment of troops across was based on calls for them from general headquarters in Europe. Some differences of opinion had developed in France as to the number of American ambulance sections required by the French Army, and until these were adjusted no place on the priority sailing lists could be secured for the sections which were impatiently waiting transportation at Camp Crane. Finally 10 more sections at the end of December, 1917, 17 sections in January, and 5 in March, 1918, went across, making a total of 52 sections sent from Camp Crane in service in France before the armistice was signed. The French contingent of the United States Army Ambulance Service during active hostilities, therefore, consisted of about one-third "militarized" sections and two-thirds Camp Crane sections.

Events unforeseen at the formation of the Ambulance Service resulted in modifications of the original plans in such a way that 30 of the sections originally intended for France were finally sent to Italy for service with the Italian Army; and later 15 of these sections, with a few from the French contingent, were assigned to the American Army in France.

Thus it occurred that in the decisive contests of the summer and autumn of 1918, sections of the United States Army Ambulance Service were on duty with the American Army and the Italian Army.

Troops left Camp Crane for overseas as follows:

1917, July-----	3 base hospitals.
August-----	20 Ambulance Service sections.
November-----	1 overseas gas defense service unit.
December-----	10 Ambulance Service sections; 200 casuals.
1918, January-----	17 Ambulance Service sections.
March-----	5 Ambulance Service sections; 300 casuals.
April-----	400 casuals; replacement hospitals "A"; mobile optical unit.
May-----	2 evacuation hospitals; 1 base hospital.

June.....	30 Ambulance Service sections to Italy; 1 headquarters detachment to Italy; 1 hospital detachment to Italy; 2 machine-shop truck units to Italy.
July.....	4 evacuation ambulance companies; 100 casualties (company No. 11); 1 mobile operating unit; 1 machine-shop truck unit; 4 base hospitals; 1 replacement unit (300 men).
August.....	10 automatic replacement draft units (250 men each); 1 replacement unit (100 men); X-ray unit No. 1; 1 evacuation ambulance company; 1 base hospital.
September.....	1 exceptional medical replacement draft unit (241 men); 5 automatic replacement draft units (250 men each).
October.....	1 automatic replacement draft unit; 31 Ambulance Service sections; 6 sanitary squads.
November.....	22 evacuation ambulance companies; 6 mobile hospitals; 4 mobile surgical units.
Passed through Camp Crane:	
Officers.....	2, 085
Men.....	18, 225
Total.....	20, 310

The Government property on the fair grounds was sold and removed in the early spring of 1919. The camp was formally closed, and the fair grounds turned back to the owners April 10, 1919.

REFERENCES

- (1) S. O. No. 113, W. D., 1917, detailing Lieut. Col. E. E. Persons, M. C., and Lieut. Col. P. L. Jones, M. C.
- (2) G. O. No. 75, W. D., June 23, 1917, Sec. II, pars. 1 and 2.
- (3) General Orders, No. 124, W. D., September 30, 1917.
- (4) Letter from the Surgeon General, United States Army to the commanding officer, United States Army Ambulance Corps, Allentown, Pa., July 13, 1917. Subject: Nature and scope of instruction to be given the above personnel. On file, Record Room, S. G. O., 314.7-1 (Allentown, Pa.).
- (5) Special Regulations 49a, 1917.
- (6) Letter from Maj. C. C. Hillman, M. C., to commanding officer, Concentration Camp, U. S. A. A. S., Allentown, Pa., December 4, 1917. Subject: Brief history of instruction at this camp. On file, Record Room, S. G. O., 314.7-1 (Allentown, Pa.).

CHAPTER IV

TRAINING IN DIVISIONAL CAMPS AND IN POSTS

IN DIVISIONAL CAMPS

One of the main purposes of the medical officers' training camps which were instituted in June, 1917,¹ was to provide for the tactical divisions, to be mobilized the following September, as great a number as possible of officers who in the intervening months would be given sufficient instruction in medico-military matters to enable them to take up on a great scale the instruction of divisional Medical Department personnel.

The scheme of training, as noted before, was the outcome of our experiences on the Mexican border, 1916-17, and was promulgated in May, 1917, to the division surgeons of divisions then existent, in order that the work to be done along this line in the medical officers' training camps might be anticipated somewhat. These instructions were as follows:²

1. These instructions are intended to coordinate the training of officers and enlisted men of the Medical Department with that to be given at the training camps of the Medical Department, of which it is expected that four will shortly be established. In order that such instruction shall be standardized throughout the military service, the general provisions of this letter will be strictly carried out. All details of execution are left to you, and you are held responsible for proper results.

2. To this end, you will appoint a specially qualified officer as "training officer," whose chief functions will be, under you, to take charge of the details of training work and by close supervision see that these are effectively carried out. You will also yourself give much attention to this highly important matter, by supervision, inspection, etc.

You will also make arrangements by which the routine duties of medical officers and men serving with troops shall not unduly interfere with their systematic and progressive instruction and training.

3. The course of instruction is intended to be basic. Training will be intensive and pushed as rapidly as possible. The services of thousands of instructed medical officers must be available at an early date. They must be fitted to intelligently undertake field work with independent organizations, under conditions in which many of them will not have either the supervision of trained officers or the aid of well-qualified noncommissioned officers. The training, drilling, etc., of the many thousands of enlisted recruits of the Medical Department will shortly devolve upon them. They must be thoroughly qualified to do it. The military exigency requires that few trained medical officers can be spared for your division. Their places will have to be filled by medical officers of the Officers' Reserve Corps, most of whom will be absolutely without experience or training. The responsibility for seeing that they get such training in an effective way and in as short a time as possible rests with you. New officers, as they may join you subsequently, will be at once put under training.

4. Your staff of instructors will have to be arranged for by you. Individuals who are qualified and those only partly qualified will have to instruct those who are not qualified at all. You will make every effort to assign as instructors in any subject officers who are especially conversant therewith. Where troops are aggregated in considerable numbers, you will organize general classes or schools, with fixed hours for sessions. Where the sanitary personnel is present in small numbers, its instruction will nevertheless be systematically prosecuted, and its efficiency checked up by frequent inspection by yourself and your assistants. For assistance in map reading, the tactical part of medicomilitary problems and maneuvers, and special lectures, you should secure the services of selected line officers.

5. Instruction will as far as possible be by recitations in theory, and demonstrations in practice. Student officers should be made to grasp the principles, and then visualize the organizations, apparatus, and methods concerned. To this end, for example, all sanitary appliances and methods likely to be of use in field work will be procured or constructed and kept in operation, and systematized demonstration will be made of their purpose and practical use. Bombproofs will be constructed, protective apparatus against poison gas tested, etc. All official papers required will actually be made out until familiarity therewith and correctness of result is secured. Applied camp sanitation will be taught by sanitary inspections. Drills will be prosecuted until every medical officer can himself handle and instruct therein the enlisted personnel of the Medical Department. Officers and men will be given interchangeable duty, for fixed periods, between the regimental detachments, ambulance companies, and field hospitals to learn their internal administration and their handling on marches and comprehensive field problems.

6. The training course for officers will be divided into three periods: The first, while instructing the officer as such, is intended especially to familiarize him with the duties of the enlisted recruits of the Medical Department which he will shortly be called on to train. The second takes up his training in his own special functions as an officer. The third carries on and completes the course of the second period. As fast as an officer qualifies in a subject, he will be advanced to another. Ordinarily, qualification will be determined by brief oral examination or practical demonstration.

7. The following official books will be used in the course of instruction: Army Regulations; Field Service Regulations; Manual for the Medical Department; Tables of Organization; Drill Regulations for Sanitary Troops; Manual for Courts-Martial. You will at once make requisition so that each officer not fully supplied will have a copy. Any other books which may be used will be announced later. You will make requisition for enough war-game maps and sets so that each officer will have access thereto. Procure maps of any maneuver grounds in the vicinity of camps which will be used in your maneuver work and if possible issue a copy to each officer.

8. You will arrange, if possible, to give at least four hours systematized and progressive instruction to medical officers daily, except Saturday afternoon and Sunday. The daily schedules for such instruction you will prepare yourself, bearing in mind the subjects to be covered and the time which it is desired to devote to each subject, as set forth later in this letter. Schedules should be made out for one month at a time, following the plan of dividing the instruction into three periods. Copy of schedule as prepared by you will be furnished to this office without delay. Effort should be made to arrange routine duty so that the entire afternoon can be devoted to instruction, with, if possible, one hour in the morning in addition.

9. The following subjects will be thoroughly taught during the first period: Setting-up exercises (15 minutes daily); drills, 2 hours daily; inspections; equitation; bridling, saddling and care of animals; tent pitching, shelter and pyramidal; personal equipment of sanitary soldier; field and surplus kits; care of equipment; first aid, using soldier's equipment only; examination of recruits, including papers and finger prints; nature and employment of regimental medical supplies; customs of the service; relation of Medical Department to rest of Army; general organization of the Medical Department for war; general organization of military forces; Manual for the Medical Department; Army Regulations; military hygiene and sanitation; Field Service Regulations; paper work relating to the Medical Department; map reading, use of compass, orientation, etc.

The second period will include: Setting-up drill (15 minutes daily); drills (1 hour daily); inspections, equitation, and care of animals; tent pitching, hospital tentage; elementary position and road sketching; the regimental detachment, its use and internal administration; the ambulance company, its equipment, use and internal administration; the field hospital, its equipment, use and internal administration; lectures by line officers on the tactical use each of Infantry, Cavalry, Field Artillery, Signal Corps, Engineer Corps, and quartermasters' supply work in the field; paper work relating to the Medical, Quartermaster, and Ordnance Departments (continued); the Medical Department in campaign; the principles of sanitary tactics; map problems; war games; military hygiene and sanitation (continued); Army Regulations (continued); Manual for the Medical Department (continued).

The third period will include: Setting-up drill (15 minutes daily); drills (1 hour daily); inspections; handling of rations and mess management; Manual for Courts-Martial; Articles of War; Geneva and Hague conventions; The Rules of Land Warfare; military surgery; poison gases, their nature, protection against, and treatment of; liquid fire; shell shock; war psychoses and neuroses; malingering; demonstration of trench system, including bombproofs, dugouts, entanglements, abatis, etc.; trench warfare, "trench foot"; cantonment hospitals, their organization and management; sanitary service, lines of communication; hospital ships, ships for patients, hospital trains and trains for patients; base hospitals, their organization and management; contagious disease hospitals, casual camps, convalescent camps, camps for prisoners of war; organization, functions, and limitations of the American Red Cross; civil sanitary function of the Army Medical Department in occupied territory; war games; tactical walks and rides; sanitary inspections; practice march and bivouac (2 days); practical field maneuvers, including brigade and divisional problems, with not less than two night problems, and using regimental detachments, ambulance companies, field hospitals, stations for slightly wounded. "Dummy" wounded in large numbers will actually be handled. Problems will include the attack, retreat, planned defense, and encounter, with all arms.

10. Dental surgeons and veterinary surgeons will take the general course for medical officers, with the exception of subjects which pertain more or less exclusively to the work of medical officers as such, and the substitution therefore of subjects directly relating to the dental or veterinary service. Pending instructions from this office, you will arrange tentatively for such special instruction.

11. Medical officers who demonstrate exceptional knowledge and ability as a result of this training course will be recommended by you for advancement in rank. A certain number of vacancies in the grade of major and captain are being left unfilled for this purpose. Also officers so excelling, who satisfy the age and other requirements, will be recommended by you to this office for examination with a view to their being commissioned at once as first lieutenants in the Medical Corps of the Army.

12. If any reserve officer is found unfit for the service by reason of physical, mental, moral, or temperamental reason, you will recommend to this office his separation from the service.

13. You will arrange with military hospitals in the vicinity of troops to furnish facilities for instruction of medical officers in the administration of such hospitals, and in the training of enlisted men as nurses and surgical assistants.

14. Pending further instructions from this office, you will prepare and put into effective operation, without delay, a course of intensive instruction and training for enlisted men of the Medical Department. Schedule of the above will be furnished this office. Eight hours of instruction per day, except Saturday and Sunday, will be required. Four hours' instruction will be required on Saturdays. In computing the amount of instruction given, the time actually consumed by enlisted men in the performance of regular duties will be given credit.

15. You will arrange for advanced instruction to be given selected men with a view to their promotion to be noncommissioned officers or assignment as nurses, surgical assistants, dispensary assistants, dental surgeons' assistants, and clerks. Copy of your plans and schedules will be furnished this office.

16. In view of the great need for noncommissioned officers, it is desired to promote selected enlisted men as rapidly as they are found qualified.

17. Selected men to be cooks, horseshoers, farriers, saddlers, mechanics, and chauffeurs should be instructed in such general training institutions for these subjects as are, or may be, available to the enlisted men of the line in your division.

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Unfortunately, it was impossible to provide accommodations at medical officers' training camps for all the officers and enlisted men that would be required for the Medical Department units of the divisions organized in the early fall of 1917; other units had to be provided for besides the divisional units, and these had to be organized simultaneously. Consequently, though

104 medical officers and 1,455 enlisted men, Medical Department, were required for each of the divisions organized under War Department Tables of Organization, August, 1917, only 60 medical officers and 310 enlisted men, partially trained, could be furnished for each of the National Army divisions so organized.³

On October 3, 1917, the following letter of instruction,⁴ sent to the division surgeon of each division, augmenting instructions previously issued, was intended as an outline for the training of all divisional Medical Department personnel. The course of instruction thus prescribed was to be carried out as rapidly and as completely as local conditions permitted, and was to be concluded only when the Medical Department personnel under instruction demonstrated their qualification before a board of medical officers appointed by the division surgeon.

1. These instructions are intended to coordinate the work of training medical personnel in all divisions so that it may be carried out on common lines. To this end, the general provisions of this letter will be strictly observed. All details of execution are left to you, and you are held responsible for proper results.

2. With the concentration of troops in divisions, each division will, so far as the Medical Department is concerned, constitute a training unit for its sanitary personnel, both commissioned and enlisted.

3. This training will consist of two parts, one in which the medical personnel is trained in their military duties and military environment, the other in which the medical personnel is trained in such professional matters as are created or affected by such military environment. Both are necessary.

4. It is realized that with the organization of new troops there must first be a period for organization, equipment, and supply. Under such conditions, with green men, the performance of almost any military duty is new and valuable as a matter of education. For this reason, the scope of instruction may safely be left to detachment and unit commanders for some weeks, subject to the oversight of the division surgeon. But on November 1 the present plan of medical divisional training will be put into operation and continued as long as the division remains in the United States.

5. This Nation is at war, and training must be intensive and arduous so that the sanitary personnel may be fitted for service with the least possible delay. It is a time which calls for every effort and self-sacrifice, and sloth, indifference, and inertia on the part of individuals must not be tolerated. The efficiency of the Medical Department as a whole, as well as in each division, with a personnel composed in large part of those inexperienced in the military service, very clearly depends upon the thoroughness and efficiency with which training is carried out.

6. It must be emphasized that the duties of the Medical Department are multifarious, that all are necessary, that any and all individuals may be called upon with little or no notice to perform them, and that training in one line of sanitary duty may give little or no preparation for other lines of work equally important. It is not possible to limit the liability of any individual to one class of duty. Hence each must be prepared to efficiently carry out any of the various duties which he will very likely be called upon to perform from time to time.

7. It is obvious that the proper performance of the routine daily duties of the sanitary personnel is of the greatest immediate importance and must be effectively carried out. But it is equally true that some hours daily should be available after this daily routine is accomplished, and this spare time should be effectively used in preparing for future duties and probable contingencies.

8. Training will be carried out under direction of the division surgeon, who will prepare a schedule of systematic training in general conformance with this letter of instructions, and submit the same to the division commander, with request that it be issued as a division order. The division surgeon will see that the provisions of such order as may be issued are strictly carried out in both letter and spirit, and that every opportunity for training is taken advantage of by study, drill, and field exercises.

9. To assist him in this most important work of preparing his sanitary personnel for war service, the division surgeon will designate a suitable medical officer as "training officer," and if necessary request his relief from other duties. The duties of the "training officer" will be, under the division surgeon, to classify the personnel, both commissioned and enlisted, into suitable groups for training according to their relative knowledge and experience, arrange for competent instructors, recommend the subjects and hours of instruction for each group, and, by constant supervision and assistance, verify and promote the efficiency of the training work.

10. In each camp there will be found a considerable proportion of officers and men who have had a certain amount of military experience, either at a medical officers' training camp or through previous service. This personnel should be sought out and their services fully utilized as instructors. The well trained must aid the partly trained, and both must unite to teach what they know to the large group of the wholly uninstructed. They are the instructors upon whom the training officer must rely to carry out the details of his work.

11. Officers and men detailed by you as instructors should be given special authority while serving as such, irrespective of rank.

12. In a general way, the course of instruction should be considered to cover about a three months' period. Schedules should provide for its completion by January 15 to February 1. Troops going abroad before that time will necessarily discontinue this course of training.

13. Attendance at all training exercises and lyceums is a military duty. No person should be excused from attendance except for official reasons and in emergency. Check lists of attendance will be kept and absentees reported to the proper officer. Excessive routine duty will not be accepted by this office as an excuse for failure to carry out a reasonable amount of training.

14. As far as possible, the training to be given sanitary personnel will be coordinated. For this purpose, there must be systematized rotations of duty. As soon as an officer or enlisted man is able to efficiently perform the task set him, he should be given opportunity to learn something else. The regimental sanitary personnel, after becoming competent to handle regimental work, should be temporarily assigned in detachments to ambulance companies and field hospitals—and vice versa—for mutual familiarity with the duties and methods of these diverse organizations. It is realized that these changes of duty for instruction purposes may be objected to by subordinate commanders as interfering with the highest efficiency of their organizations. Such objections should not be entertained. The efficiency of the medical service of the division as a whole is first to be considered, and until this has been secured to the satisfaction of the division surgeon all regimental detachments and sanitary units of the division should be regarded as training organizations.

15. The subjects in which medical officers must be qualified are as follows:

Setting up. Medical officers will take this daily with the troops to which they are attached.

Drills; marching, litter, ambulance, other means of transport.

Inspections; personnel and environment.

Equitation; saddling, bridling, care of animals.

Tent pitching.

Personal equipment of the soldiers; its care, field and surplus kits.

First aid; using soldiers' equipment.

Examination of recruits, with papers and finger prints.

General organization of the military forces of the United States.

General organization of the Medical Department for war.

Relation of the Medical Department to the rest of the Army.

Paper work, relating to the Medical Department.

Paper work, relating to the Quartermaster's Department.

Paper work, relating to the Ordnance Department.

Customs of the service.

Duties of the soldier.

Army Regulations.

Manual for the Medical Department.

Field Service Regulations.

Military hygiene, and applied camp sanitation, including sanitary inspections.

Map reading, use of compass, orientation, etc.

Elementary road and position sketching.

The regimental detachment; its use, equipment, and administration.

The ambulance company; its use, equipment, and administration.

The field hospital; its use, equipment, and administration.

The Medical Department in campaign.

The principles of sanitary tactics.

The tactical use of Infantry (lecture by line officer).

The tactical use of Field Artillery (lecture by line officer).

The tactical use of Cavalry (lecture by line officer).

The uses of the Engineer and Signal Corps (lecture by officers of service concerned).

The service and mechanism of quartermaster supply in the field (lecture by quartermaster).

Map problems.

War games.

Tactical walks and rides.

Practice marches and bivouacs.

Practical field maneuvers, including brigade and divisional problems, with not less than three night problems utilizing regimental detachments, ambulance companies, and field hospitals in coordination. Problems will include the attack, retreat, planned defense, and rencounter, with all arms. As far as possible, they will be carried out in actual conjunction with problems by line troops.

Handling of ration, food economy, and mess management.

Manual for Courts-Martial and Military Law.

The Articles of War.

The Geneva and Hague conventions.

The Rules of Land Warfare.

Military surgery.

Poison gases, protection against, and their effects.

Liquid fire, trench foot.

Shell shock; war psychoses and neuroses.

Diseases common on the Western Front.

Malingering.

Cantonment, evacuation, base and general hospitals, including their organization, administration, records, management, etc.

Sanitary service of the line of communications.

Contagious disease hospitals, casual camps, convalescent camps, camps for prisoners of war.

Organizations, functions, and limitations of the American Red Cross.

The civil sanitary function of the Army Medical Department in occupied territory.

All medical officers of the division will be required to qualify in the entire course.

16. Much of the instruction should be by recitations and field work. In connection with paper work, all papers required by the medical and other departments will be actually made out until familiarity therewith and the correctness of result is secured.

17. To insure due diligence in training work, a board of three senior medical officers should be established in each camp to verify the competency in each subject of officers reported to them as qualified therein. No officer should be excused from training in a subject until the above board has reported him as qualified.

18. The attention of all officers, with the division, should be drawn to the fact that their efficiency and value to the service will largely depend upon the use they make of their opportunities for training.

The second increment of the National Army will come into being about the time the training of your medical officers will be completed. A large number of officers competent to

perform the more important duties connected with this second draft will be required. This office proposes to call for recommendation as to the medical officers and enlisted men of present divisions who by their zeal, industry, and aptitude have fitted themselves for positions of higher rank and larger authority with organizations to be created later.

19. On the other hand, medical officers who through indifference or inertia fail to qualify themselves properly for their duties, and who do not respond to local disciplinary measures, should be recommended by you to this office for summary separation from the service.

20. It is proposed to check up the efficiency of divisional training by frequent inspections of officers of the Inspector General's Department and by special inspectors from this office.

21. The textbooks authorized and published by the Government are as follows:

- Army Regulations.
- Manual for the Medical Department.
- Drill Regulations for Sanitary Troops.
- Field Service Regulations.
- Rules of Land Warfare.
- Tables of Organization.

Each officer should possess a copy for study and reference. You should make requisition without delay for such number of those as may be required to meet the needs of the commissioned and enlisted personnel of your division.

22. The books of reference authorized are as follows:

- Military Hygiene, Ashburn.
- Sanitation in War, Lelean.
- Notes on Sanitation, Vedder.
- Gunshot Injuries, LaGarde.
- Military Surgery, Penhallow.
- Sanitary Tactics, Munson.
- Medical Service in Campaign, Straub.

Also any handbooks published under authority of the Surgeon General.

It is intended that a sufficient number of these should be kept in the base hospital, to meet all needs. They should be kept in the hospital library, and be loaned as required to all medical officers.

Professional magazines issued to such hospitals should be available to all concerned.

23. Training will, as far as possible, be made practical. Medical officers and enlisted men of the Medical Department, after learning in theory how a duty should be performed, should be made to actually do it in practice.

24. Divisional sanitary detachments and units must not be allowed to become sedentary. Drills about camp and short marches with return to camp are not sufficient. There must be frequent "hikes" of several days duration, with overnight camps. Nothing prepares for field service like field service.

A minimum of eight hours work a day should be required. There should be not less than four hours work on Saturday. Credit should be allowed for time actually spent in the performance of necessary routine duties. Sunday should be regarded as a day of rest. In addition, not less than three evenings a week should be designated as lyceum nights, when all available medical officers should be required to meet for lectures, conferences, discussions, clinics, war games, etc., on matters pertaining to the medical sciences and military service.

25. Beside the training along medico-military lines already outlined, there must be training along professional lines, especially when these are subject to modification from civilian standards by reason of military necessity and environment. There is opportunity to broaden the outlook and add to the professional efficiency of all. But the professional subjects in which there is an immediate and direct application to the military service are of the first importance.

26. As part of the training course along professional lines, the various specialists attached to the base hospitals, and others sent out by this office, will give outline courses along the lines of their work on which it is important that medical officers in general should be informed. These will take the form of lectures, demonstrations, clinics, presentation of cases, etc. Instructions as to the nature and scope of the formal instruction to be thus given will be sent direct by the several specialists, divisions of this office to the specialists concerned.

27. The subjects of general and orthopedic surgery, general and military medicine, advances in hygiene and sanitation, diseases and injuries of the brain, head, eye, ear, nose,

and throat, bacteriology and pathology, genitourinary diseases, psychiatry and neurology, Roentgenology, and medical and surgical supplies will be thus covered.

28. The lectures, demonstrations, etc., to be given by specialists in their respective subjects are to be practical. They are not intended to turn the general practitioner class of medical officers into specialists, but to outline to such general practitioners their part in the prevention and cure of important disorders and disabilities through early diagnosis and proper action and the manner in which specialists can be of service to them in the more obscure cases of illness or injury, with some discussion of the specialists' methods to be employed. They are intended to demonstrate how better professional teamwork may be accomplished.

29. This course of instruction by specialists and lyceums will be arranged by the commanding officer, base hospital, who should confer with the division surgeon as to the hours and places most convenient for all concerned.

30. This office proposes to maintain a circuit for certain lectures by authorities in their subjects, to be illustrated by moving pictures and lantern slides. The adjutant of the Army Medical School, Washington, D. C., will handle all details relative to this illustrated lecture circuit. Moving pictures of a nonprofessional nature, but illustrating general military service with troops, will also be sent out for exhibition. The purpose of these pictures is to familiarize medical officers with the conditions and difficulties of the military environment, and of the functions of the other branches of the service with whom they will be associated. The exhibition of such pictures will be credited as part of the lyceum course.

31. You will also prepare a course of training for enlisted men, intended to familiarize them, first, with their present duties, and then systematically give them an insight into the other varieties of service under the Medical Department which they may be at any time called upon to perform.

32. You will also establish and maintain a school for candidates for promotion as non-commissioned officers. Details of this course are left to you.

33. Suitable arrangements will be made by you for the effective special instruction of selected men required for dispensary and surgical assistants, ward masters, clerks, cooks, chauffeurs, blacksmiths, farriers, saddlers, and other special duties.

34. Schedules of instruction covering the above subjects will be prepared by you without delay. Copies of such schedules will be furnished this office for its information prior to the beginning of the training course.

35. The mounts and animals of the regimental detachments, ambulance companies, and field hospitals should be used in instruction of all officers and enlisted men in equitation, driving, and packing.

* * * * *

The proportion of Medical Department personnel called into the service which could be accommodated at the medical officers' training camps became smaller as time passed, and the incoming draft increments increased and the number of officers and men ordered directly to divisions, who had never received any military training whatever, continued to increase in the same proportion. During the summer of 1918 it became a matter of great importance that these officers be given intensive training and instruction. Therefore, the Surgeon General sent out another circular letter of instruction, calling attention to the above facts and citing Special Regulations, No. 49a, War Department 1917, and previous letters of instruction as a basis upon which intensive instruction was to be placed.⁵

While the divisions were undergoing organization and training for overseas service in the cantonments in the United States during the early months of our participation in the war, the division surgeon exercised the function of camp surgeon as well as that of division surgeon, and was responsible for the training of all sanitary troops in the camp in accordance with the training plans formulated under the direction of the Surgeon General, except those assigned to the camp base hospitals. It was the intention of the Surgeon General, however, in the issuance of circular letter of instruction on October 3, 1917,⁴

to all division surgeons, and the circular letter to the commanding officers of all base and general hospitals, on November 1, 1917,⁶ that the instruction in the cantonments be correlated in such a way that the professional training of all officers in the camps be conducted by the specialists assigned to base hospitals, each one of whom, as a rule, was eminently qualified to give this instruction in his particular branch of medicine, and that the military instruction of all sanitary personnel be given by officers assigned to the field units of the camp. It was also intended that enlisted men from the divisional units be assigned to the base hospitals for training in nursing, ward management, the duties of operating room, orderlies, etc., and in the majority of the camps this was accomplished, especially during the latter part of the war.

When the division surgeon acted also as the camp surgeon, on the departure of the divisions for overseas service, the camps were often left without an organized camp surgeon's office, or without either commissioned or enlisted personnel commensurate with the needs of the camps, and often the division surgeon took away with him all records pertaining to the camp.⁷ In order to correct this condition and to correlate the activities of the various units, the Surgeon General decided to assign camp surgeons and the necessary sanitary personnel to all camps, to complete the organization of a camp surgeon's office, and the division surgeons were notified that in case this had not been accomplished they should take steps to select the necessary personnel from the officers and enlisted men who were to remain, to complete such an organization and to instruct them in their duties before the departure of the division, or that in the event the necessary personnel was not available, to make telegraphic request to the Surgeon General for them.⁷ The following scheme for the organization of Medical Department activities of a large camp, which had been developed at one of our large camps, was thought so well of by the Surgeon General that, on May 27, 1918, it was promulgated by him in memorandum form to all camp surgeons, to be used as a guide in organizing the camp surgeon's office.⁸

1. The attached scheme for the organization of Medical Department activities at a large camp is furnished for your information. This plan received the highest commendation from the commanding general of the camp in question and appears to cover in an exceptionally complete manner the various functions of the Medical Department. It is not intended that this plan should necessarily be adopted as a standard, but it is desired that you give it careful study with a view to correcting any defects which you may find in your camp organization.

HEADQUARTERS CAMP BLANK,
OFFICE OF THE CAMP SURGEON,
May 10, 1918.

From: The Camp Surgeon.

To: The Adjutant General of the Army, Washington, D. C. (through the commandant Camp Blank).

Subject: Organization of the medical department of a camp.

1. The various activities of the Medical Department at a large receiving camp, such as Camp Blank, have been left, as far as the Tables of Organization are concerned, to each camp surgeon to work out as he sees fit.

2. A camp, such as Blank, is permanent in its character, and it is suggested that a medical officer of at least the rank of colonel be assigned permanently as camp surgeon to coordinate the work of the different divisions and the depot brigade. He should have a permanent staff, both commissioned and enlisted, and the sanitation of the entire camp should be directly under his supervision.

3. The organization of the medical department of the division is fully covered by the Tables of Organization.

4. The depot brigade is a permanent organization, and its activities are so varied that it is believed that a complete and coordinated medical organization should be prescribed. This should be permanent, and should be sufficiently elastic to meet the many emergencies which may arise in the brigade.

5. As at present organized in this camp, the medical activities consist of seven different services and embody seven special boards, as follows:

(a) Services:

- (1) Examination of recruits.
- (2) Remedial defects.
- (3) Venereal.
- (4) Detention camp.
- (5) Quarantine camp.
- (6) Infirmaries.
- (7) Dental.

(b) Special boards:

- (1) Tubercular.
- (2) Neuropsychiatric.
- (3) Eye and ear.
- (4) Orthopedic.
- (6) Genitourinary.
- (7) Psychological.

6. The examination service has assigned to it 9 commissioned officers, and during the periods when men are being received the special boards work in conjunction with this service.

7. The remedial defects service has 5 commissioned officers assigned to it, whose duties are to prescribe drill and exercise to develop defectives, supervise their work, and make recommendations as to the suitable final disposition of these men. The special boards also act as consultants for the various classes of defects coming under their specialties.

8. There are 6 to 8 officers assigned to the detention camp, who act as camp surgeons, complete inoculations and vaccinations, and complete the medical records of the men. While in this camp, an orthopedic survey is made of the men, and corrective drill is instituted where necessary.

9. At the quarantine camp 6 officers are assigned, who act as camp surgeons, treat meningitis carriers, diphtheria carriers, and perform the various duties necessary to the health of the various contacts.

10. The venereal service has three officers assigned to it. This service treats all cases of syphilis and supervises the treatment of all cases of gonorrhea in camp. The service keeps the necessary records. This service is very important, as is evidenced by the fact that from 3 to 5 per cent of all drafted men have venereal disease when received.

11. The infirmary service comprises the battalion medical service, 2 officers being assigned each training battalion (Tables of Organization). This personnel may be cut considerably if this proposed organization is adopted, 3 battalions being served at 1 infirmary and 3 medical officers assigned to each infirmary.

12. The dental service has 11 dental surgeons assigned, with a completely equipped dental infirmary.

13. The various boards examine men when received and act as consultants in their specialties.

14. It has been found that this organization fulfills all the requirements of the depot brigade and is able to handle the work in an efficient manner. It is therefore recommended that the following Medical Department organizations be prescribed for National Army camps:

- 1 colonel, camp surgeon.
- 1 major, assistant to camp surgeon.
- 1 captain, assistant to camp surgeon.
- 1 major, sanitary inspector.
- 8 captains or first lieutenants, assistants to sanitary inspector.
- 1 lieutenant colonel, surgeon, depot brigade.
- 1 captain, assistant to surgeon.
- Examination service:
 - 1 major.
 - 8 captains or first lieutenants.
- Remediable defects battalion:
 - 1 major.
 - 4 captains or first lieutenants.
- Venereal service:
 - 1 major.
 - 2 captains or first lieutenants.
- Detention camp service:
 - 1 major.
 - 5 to 7 captains or first lieutenants.
- Infirmaries:
 - 1 captain or first lieutenant to each training battalion.
- Dental service:
 - 1 major.
 - 10 captains or first lieutenants.

Special boards:

Tubercular—

1 major.

4 captains or first lieutenants.

Cardiovascular—

1 major.

2 captains or first lieutenants.

Neuropsychiatric—

1 major.

4 captains or first lieutenants.

Eye and ear—

2 captains.

Orthopedic—

1 major.

2 captains or first lieutenants.

Psychological—

2 captains or first lieutenants.

15. This organization calls for 73 to 82 medical officers, according to the number of battalions; 11 dental and 2 Sanitary Corps officers.

GENERAL TRAINING FOR MEDICAL OFFICERS

In general, the principle underlying training of medical officers of tactical divisions was the same for all: (a) Basic military training; (b) special training, so as to permit an officer of the Medical Department to function; (c) training to develop organization efficiency.

The training of officers was made as practical as possible, the intention being to instill discipline, to enhance the ability to command, and to develop qualities of leadership and morale. Medical officers who reported without previous military training were ordered to drill in ranks, under the direction of those who had received basic training in medical training camp, in order that they might learn rapidly and acquire ability to execute drill movements. As soon as they proved themselves, they were given command. The character of the training of officers was varied. Calisthenics, sick call, sanitary inspections, field work, classroom work, and lectures were a part of each day's schedule.

Division surgeons kept in close contact with the units by frequent conference with all medical officers in order that developing problems might be solved and uniformity in training attained so as to insure proper coordination in the function of regimental detachments with the units of sanitary trains. Officers were given detailed theoretical and practical instruction in the methods of sanitary control, a complete sanitary inspection of every unit area being made each day by the medical officer selected, who made a report and recommendations to the division surgeon. Lectures were conducted 10 hours a week in some divisions (at night) where courses in Army Regulations, organization, tactics, and technique of the Medical Department, administration and sanitary tactics were developed. Papers on medico-military subjects of special importance with relation to war were read, analyzed, and discussed.

Without warning, regimental detachments or units of the sanitary train were called out and required to march with full impedimenta and to establish their stations at points designated on maps by the division surgeon. Drill schedules were outlined by the senior medical officer, and subordinates were made responsible for the execution of them. Medical officers were required to make themselves proficient in all forms of Medical Department drill, and later to operate their detachments on the field under as nearly actual conditions as they would exist in combat. They were instructed in trench warfare, approach of trenches, approved methods of evacuating the wounded in conjunction with ambulance dressing stations and field hospitals. The following is an example of a schedule of instruction for the medical officers of a division:⁹

Schedule of training for officers, Medical Department

	Thursday, Nov. 1	Friday, Nov. 2	Saturday, Nov. 3	Monday, Nov. 5	Tuesday, Nov. 6	Wednesday, Nov. 7	Thursday, Nov. 8	Friday, Nov. 9
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Drill, school of soldier, etc.	Drill, school of soldier, etc.	Inspection	Drill	Drill	Drill	Drill	Drill
9.40 to 10.25 a. m.	Drill, school of detachment, etc.	Drill, school of detachment, etc.	Drill or inspection	Drill	Drill	Drill	Drill	Drill
10.35 to 11.20 a. m.	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations
11.30 a. m. to 12.15 p. m.	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Duties of the soldier	Duties of the soldier	No instruction	The regimental detachment, the ambulance company, the field hospital; nature and employment of its equipment and its administration (each taught to the organization concerned)				
2.25 to 3.10 p. m.	Examination of recruits with all required papers and finger prints	Examination of recruits with all required papers and finger prints	No instruction	Military hygiene and sanitation	Military hygiene and sanitation	Military hygiene and sanitation	First aid, using soldiers' equipment only	The regimental detachment, the ambulance company, the field hospital, etc.
3.20 to 4.05 p. m.	Examination of recruits with all required papers and finger prints	Examination of recruits with all required papers and finger prints	No instruction	Duties of the soldier	Open	Open	First aid, using soldiers' equipment only	Open
4.15 to 5 p. m.	Open	Open	No instruction	Open	Open	Open	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7.45 p. m.	Relation of the Medical Department to the rest of the Army	Unit surgeons' conference with the adjutant	No instruction	Unit surgeons' conference with the adjutant	Use of compass and orientation	Map reading	Map reading	Unit surgeons' conference with the adjutant

8 to 8.45 p. m.	Customs of the service	Monday, Nov. 10	Unit surgeons' conference with the adjutant	No instruction	Wednesday, Nov. 14	Orientation and use of the compass	Map reading	Map reading	Unit surgeons' conference with the adjutant
		Saturday, Nov. 10	Monday, Nov. 12	Tuesday, Nov. 13	Wednesday, Nov. 14	Thursday, Nov. 15	Friday, Nov. 16	Saturday, Nov. 17	Monday, Nov. 19
7.45 to 8.30 a. m.		Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Inspection	Drill	Drill	Drill	Litter drill	Litter drill	Litter drill	Inspection	Drill
9.40 to 10.25 a. m.	Drill or inspection	Drill		Drill	Litter drill	Litter drill	Litter drill or inspection	Litter drill	Drill
10.35 to 11.20 a. m.	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Army Regulations	Paper work relating to the Medical Department	Paper work relating to the Medical Department	Paper work relating to the Medical Department
11.30 a. m. to 12.15 p. m.	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Manual for the Medical Department	Paper work relating to the Medical Department	Paper work relating to the Medical Department	Paper work relating to the Medical Department
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	No instruction	The regimental detachment, the ambulance company, the field hospital, etc.		Orthopedies; foot-wear, and care of the feet	Orthopedies; foot-wear, and care of the feet	Personal equipment of the sanitary soldier; its maintenance and care	Maintenance and care of the soldiers' sanitary equipment	No instruction	Pitching of hospital tentage; carried out in the sanitary train
2.25 to 3.10 p. m.	No instruction	Military hygiene and sanitation	Military hygiene and sanitation	Orthopedies; foot-wear, and care of the feet	Orthopedies; foot-wear, and care of the feet	Personal equipment of the sanitary soldier; its maintenance and care	Field and surplus kits	No instruction	Pitching of hospital tentage; carried out in the sanitary train
3.20 to 4.05 p. m.	Open	Open	Open	Open	Open	Pitching of shelter tents, if available	Pitching of pyramidal tentage, if available	No instruction	Pitching of hospital tentage; carried out in the sanitary train

Schedule of training for officers, *Medical Department*—Continued

	Saturday, Nov. 10	Monday, Nov. 12	Tuesday, Nov. 13	Wednesday, Nov. 14	Thursday, Nov. 15	Friday, Nov. 16	Saturday, Nov. 17	Monday, Nov. 19
4.15 to 5 p. m.	Open	Open	Open	Open	Pitching of shelter tents, if available	Pitching of pyramidal tentage, if available	No instruction	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7.45 p. m.	No instruction	Unit surgeons' conference with the adjutant	Position and road sketching	Position and road sketching	Position and road sketching	Unit surgeons' conference with the adjutant	No instruction	Unit surgeons' conference with the adjutant
8 to 8.45 p. m.	No instruction	Unit surgeons' conference with the adjutant	Position and road sketching	Position and road sketching	Position and road sketching	Unit surgeons' conference with the adjutant	No instruction	Unit surgeons' conference with the adjutant
	Tuesday, Nov. 20	Wednesday, Nov. 21	Thursday, Nov. 22	Friday, Nov. 23	Saturday, Nov. 24	Monday, Nov. 26	Tuesday, Nov. 27	Wednesday, Nov. 28
7.45 to 8.30 a. m.	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds
8.40 to 9.25 a. m.	Drill, litter and carrying	Drill	Drill	Drill, litter and carrying	Inspection	Drill	Litter and carrying drill	Drill
9.40 to 10.25 a. m.	Drill, litter and carrying	Drill	Drill	Drill	Drill or inspection	Drill	Litter and carrying drill	Drill
10.35 to 11.20 a. m.	Paper work relating to the Medical Department	Paper work relating to the Medical Department	Paper work relating to the Medical Department	General organization of the military forces of the United States	General organization of the military forces of the United States	General organization of the military forces of the United States	The Articles of War	The Articles of War
11.30 a. m. to 12.15 p. m.	Paper work relating to the Medical Department	Paper work relating to the Medical Department	Paper work relating to the Medical Department	General organization of the military forces of the United States	General organization of the military forces of the United States	General organization of the military forces of the United States	The Medical Department in campaign	The Medical Department in campaign
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Practical demonstration of military hygiene and sanitation at Fort Riley	Practical demonstration of military hygiene and sanitation at Fort Riley	Practical demonstration of military hygiene and sanitation, etc.	Practical demonstration of military hygiene and sanitation, etc.	No instruction	Practical demonstration of military hygiene and sanitation at Fort Riley	The principles of sanitary tactics	The principles of sanitary tactics

2.25 to 3.10 p. m.	Practical demonstration of military hygiene and sanitation at Fort Riley	Practical demonstration of military hygiene and sanitation, etc.	Practical demonstration of military hygiene and sanitation, etc.	No instruction	Practical demonstration of military hygiene and sanitation at Fort Riley	The principles of sanitary tactics
3.20 to 4.05 p. m.	Same as above	Same as above	Same as above	No instruction	Same as above	Equitation: Lecture on care of animals by a veterinarian if possible
4.15 to 5 p. m.	Open	Open	Open	Open	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7.45 p. m.	Paper work relating to the Quartermaster Department	Trench warfare	Unit surgeons' conference with the adjutant	No instruction	Unit surgeons' conference with the adjutant	Tactical use of Field Artillery
8 to 8.45 p. m.	Paper work relating to the Quartermaster Department	Trench warfare	Unit surgeons' conference with the adjutant	No instruction	Unit surgeons' conference with the adjutant	The Rules of Land Warfare
Thursday, Nov. 29	Friday, Nov. 30	Saturday, Dec. 1	Monday, Dec. 3	Tuesday, Dec. 4	Wednesday, Dec. 5	Thursday, Dec. 6
7.45 to 8.30 a. m.	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds
8.40 to 9.25 a. m.	Litter drill	Inspection and drill	Drill	Litter drill	Inspection or drill	Ambulance drill
9.40 to 10.25 a. m.	Litter drill	Drill	Drill	Litter drill	Inspection or drill	Ambulance drill
10.35 to 11.20 a. m.	The Articles of War	The Articles of War	The Articles of War	The Articles of War	The Articles of War	Manual for Courts-Martial and Military Law

8 40 to 9 25 a. m.	Inspection and drill	Drill	Litter and carrying drill.	Ambulance drill	Inspection or drill	Litter or carrying drill	Inspection and drill
9 40 to 10 25 a. m.	Inspection and drill	Drill	Litter and carrying drill	Ambulance drill	Inspection or drill	Litter or carrying drill	Inspection and drill
10 35 to 11 20 a. m.	Manual for Courts-Martial and Military Law	Manual for Courts-Martial and Military Law	Manual for Courts-Martial and Military Law	Manual for Courts-Martial and Military Law	Manual for Courts-Martial and Military Law	Manual for Courts-Martial and Military Law	
11 30 a. m. to 12 15 p. m.	Manual for the Medical Department	Manual for the Medical Department	Military surgery	Military surgery	Military surgery	Military surgery	Military surgery
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1 30 to 2 15 p. m.	No instruction	Field Service Regulations	Demonstrations of trench system, including bombproofs, dugouts, entanglements, abatis, etc.	Contaminant and evacuation hospitals; their organization, administration, records, management, etc.	Contaminant and evacuation hospitals, their organization, records, management, etc.	Field Service Regulations	No instruction
2 25 to 3 10 p. m.	No instruction	Open		Contaminant and evacuation hospitals, their organization, administration, records, management, etc.			No instruction
3 30 to 4 05 p. m.	No instruction	Open	Demonstrations of trench system, including bombproofs, dugouts, entanglements, abatis, etc.	Equitation; care and handling of animals by a veterinarian, if possible	Poison gases: Protection against, and their effects; demonstrations; symptoms, treatment	Same as preceding	No instruction
4 15 to 5 p. m.	No instruction	Open	Same as above	Open	Poison gases: Protection against, and their effects; demonstrations; symptoms, treatment	Same as preceding	No instruction
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7 45 p. m.	No instruction	Unit surgeons' conference with the adjutant	General organization of the Medical Department for war	Same as preceding	Trench foot	Unit surgeons' conference with the adjutant	No instruction
8 to 8 45 p. m.	No instruction	Unit surgeons' conference with the adjutant	General organization of the Medical Department for war	Same as preceding	Shell shock	Unit surgeons' conference with the adjutant	No instruction

7 to 7.45 p. m.	Unit surgeons' conference with the adjutant	Paper work relating to the Ordinance Department	Diseases common on the Western Front	War psychology and neuroses	Unit surgeons' conference with the adjutant	No instruction	Contagious disease hospitals, casual camps	Organizations, functions, and activities of the American Red Cross	Open
8 to 8.45 p. m.	Unit surgeons' conference with the adjutant	Paper work relating to the Ordinance Department	Diseases common on the Western Front	Malingering	Unit surgeons' conference with the adjutant	No instruction	Convalescent camps for prisoners of war	The civil subsidiary functions of the Army Medical Department in occupied territory	Open
	Saturday, Jan. 5	Monday, Jan. 7	Tuesday, Jan. 8	Wednesday, Jan. 9	Thursday, Jan. 10	Friday, Jan. 11	Saturday, Jan. 12	Monday, Jan. 14	Tuesday, Jan. 15
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Inspection and drill	Drill	Litter drill	Drill	Ambulance drill	Drill	Inspection and litter drill	Drill	Carrying and litter drill
9.40 to 10.25 a. m.	Inspection and drill	Drill	Litter drill	Drill	Ambulance drill	Drill	Drill	Drill	Carrying and litter drill
10.35 to 11.20 a. m.	Open	Open	Open	Demonstration of proper method of making sanitary inspection	Demonstration of proper method of making sanitary inspection	Open	Open	Open	Open
11.30 a. m. to 12.15 p. m.	Open	Open	Open	Same as above	Same as above	Open	Open	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	No instruction	Equitation	Equitation	Equitation	Open	Open	No instruction	Open	Open
2.25 to 3.10 p. m.	No instruction	Equitation	Equitation	Equitation	Open	Open	No instruction	Open	Open

Schedule of training for officers, Medical Department—Continued

	Saturday, Jan. 5	Monday, Jan. 7	Tuesday, Jan. 8	Wednesday, Jan. 9	Thursday, Jan. 10	Friday, Jan. 11	Saturday, Jan. 12	Monday, Jan. 14	Tuesday, Jan. 15
3.20 to 4.05 p. m.	No instruction	Open	Open	Open	Open	Open	No instruction	Open	Open
4.15 to 5 p. m.	No instruction	Open	Open	Open	Open	Open	No instruction	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7.45 p. m.	No instruction	Open	Open	Open	Open	Open	No instruction	Open	Open
8 to 8.45 p. m.	No instruction	Open	Open	Open	Open	Open	No instruction	Open	Open
	Wednesday, Jan. 16	Thursday, Jan. 17	Friday, Jan. 18	Saturday, Jan. 19	Monday, Jan. 21	Tuesday, Jan. 22	Wednesday, Jan. 23	Thursday, Jan. 24	Friday, Jan. 25
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Drill or inspection	Ambulance drill	Drill	Inspection and drill	Drill	Litter drill	Drill	Ambulance drill	Drill
9.40 to 10.25 a. m.	Drill	Ambulance drill	Drill	Drill	Drill	Litter drill	Inspection or drill	Ambulance drill	Drill
10.35 to 11.20 a. m.	Open	Open	Open	Open	Open	Open	Open	Open	Open
11.30 a. m. to 12.15 p. m.	Open	Open	Open	Open	Open	Open	Open	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Open	Open	Open	No instruction	Open	Open	Open	Open	Open
2.25 to 3.10 p. m.	Open	Open	Open	No instruction	Open	Open	Open	Open	Open

3:20 to 4:05 p. m.	Open	Open	Open	No instruction	Open	Open	Open	Open	Open	Open
4:15 to 5 p. m.	Open	Open	Open	No instruction	Open	Open	Open	Open	Open	Open
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
7 to 7:45 p. m	Open	Open	Open	No instruction	Open	Open	Open	Open	Open	Open
8 to 8:45 p. m.	Open	Open	Open	No instruction	Open	Open	Open	Open	Open	Open

SPECIAL TRAINING FOR OFFICERS

Instruction of medical officers of the divisions in the professional branches was generally received in the regular courses of lectures, clinics, and conferences carried out in the cantonment base hospitals as directed by the Surgeon General for all medical officers of the camps.

IN ORTHOPEDIC SURGERY

Instruction in orthopedic surgery and the care of the feet was carried out in divisions in compliance with directions from the Surgeon General. This instruction was not confined to the personnel of the division while it was in process of organization and training in cantonments, but included the training of all personnel in the camp, including that in base hospitals. The following is an example of a plan for instruction of division personnel by the division orthopedic surgeon, in compliance with War Department General Orders, No. 133, dated October 11, 1917: Medical officers were divided into two or three groups by the division surgeon, each group being given three lectures. As there were between 50 and 75 medical officers in a division, this instruction was readily and quickly accomplished, usually in connection with the division school. It is important to remember in this connection that the orthopedic surgeon was endeavoring to instruct general practitioners, and all material given them was of the simplest, plainest, and most practical character; all technical language and matters were eliminated from the lectures.

IN GAS DEFENSE

A school of gas defense was established in each divisional camp or cantonment in the United States. The director of this school was a medical officer, who had as assistants one chemist and one noncommissioned officer of the Medical Department. All officers and enlisted men in the divisions and camps were required to take the course of instruction in these schools.¹⁰

On February 27, 1918, gas defense training activities were transferred to the Engineer Corps,¹¹ and in April, 1918, the Adjutant General ordered the relief of all Medical Corps division gas officers and their replacement by Sanitary Corps officers who had been transferred to the Engineer Corps.¹²

TRAINING FOR ENLISTED PERSONNEL

From the first physical training was given priority on the schedule of instruction of enlisted men, special attention being given to exercises intended to test and develop alertness and attention to orders. Training was made progressive, beginning with physical exercises accompanied by instruction in school of the soldier, military courtesy and bearing, elaborated to the development of the individual's ability to function in the tactical operation of regimental detachments and units of the sanitary trains.

Independent maneuvers were conducted which developed the operation of all units of the Medical Department serving with the division. Medical detachments were required to participate in regimental parades and all other regimental ceremonies. Reveille and retreat formations were made a part of the daily routine, complete inspections being made as to general appearance, equipment, and soldierly bearing.

In many of the divisions, at least twice or three times a week, all divisional medical units were trained on a common drill ground. By this action the comparative progress of the units of the divisional sanitary service could be observed, and training could be modified or elaborated so as to assure knowledge of the operation of the combined units of the Medical Department and coordination of action. In addition, detachments accompanied their respective line organizations to the training field, where they carried out the prescribed schedule of instruction, rest periods being given over to instruction in first aid, venereal diseases, and personal hygiene.

When units of the divisions occupied the trenches for special instruction, the medical detachment attached thereto accompanied them, to establish aid stations and conduct training simulating trench warfare conditions.

In general there developed basic and special individual instruction which was elaborated into definitive training in the function of units of the sanitary service with organizations. This scheme as a whole was based on the intensive instruction of the individual followed by the application of the individual knowledge in the development of organization efficiency, so as to evolve thoroughly trained and coordinated sanitary services with divisions.

The following outline¹¹ and schedule¹⁴ are given as an example of the instruction carried out for the enlisted men by a division during the fall and winter of 1917-18.

OUTLINE OF BASIC INSTRUCTION FOR ENLISTED PERSONNEL AND SUBJECTS COVERED

ANATOMY AND PHYSIOLOGY

I. THE SKELETON AND JOINTS

Give strength and form; protect organs; joints permit motion.

(a) BONE (discuss the subheads briefly):

Composition.—One-third animal (gelatin); two-thirds mineral (lime); animal—toughness and elasticity; mineral—hardness.

Periosteum.—Bone covering; vascular membrane; provides nourishment; when stripped off, bone dies.

Cartilage or gristle.—Elastic substance; ends of long bones; ribs to breast bone.

Classification.—Long; short; flat; irregular, long bones, system of levers, support weight, provide locomotion; short bones, strength and limited motion; flat bones, skull, protection; irregular bones, pelvis.

Vertebral column or spine.—Buffers or pads of elastic cartilage; distribute shock; 7 cervical; 12 dorsal; 5 lumbar; 5 sacral; 4 coccyx; bony canal—contains spinal cord.

Pelvis.—Sacrum; coccyx; innominate bones, contents of.

(Four hours.)

(b) JOINTS (discuss the subheads briefly):

Synovial membrane.—Description of.

Ligaments.—Description of.

Classification of joints.—Ball-and-socket; hinge; sutures.

Dislocation.—Slipping away of joint surfaces from each other, so that they may remain out of place.

Hip joint.—Pelvis; femur.

Knee joint.—Femur; tibia; patella.

Entire bone system.—Tibia; fibula; ankle joint; tarsus; metatarsus; phalanges; ribs, 7 true, 5 false, 2 floating; breast bone or sternum; clavicle; scapula; shoulder joint; humerus; elbow joint; radius; ulna; carpus; metacarpus; phalanges; skull; number and location of permanent teeth.

(Four hours.)

II. THE MUSCLES, CELLULAR TISSUE, AND THE SKIN

(a) **MUSCLES** (discuss the subheads briefly):

Function.—To contract and thereby move the various parts and tissues of the body.
(Reason for splints on fracture.) Differentiate between contraction and retraction.

Kinds.—Voluntary; involuntary.

Actions or movements.—Flexion; extension; pronation; supination.

Rigor mortis.—Change in muscles by which they become rigid.

(Two hours.)

(b) **CELLULAR TISSUE** (discuss the subheads briefly):

Fat.—Is the padding.

Structure.—Connective tissue spongy.

(One hour.)

(c) **SKIN**.—Tough elastic membrane covering the entire body; sweat glands; sebaceous glands; purpose.

(One hour.)

III. THE NERVOUS SYSTEM AND SPECIAL SENSES

(a) **NERVOUS SYSTEM** (discuss the subheads briefly); sympathetic system:

Parts.—Brain; spinal cord; nerves; also have sympathetic system.

Brain.—Location; divisions of.

Spinal cord.—Location; functions.

Nerves.—Sensory; motor.

Special senses.—Touch; taste; smell; hearing; sight; the organs which accomplish same.

(Two hours.)

IV. THE DIGESTIVE APPARATUS

(a) **FOODS**:

Foods.—Proteids; fats; starches and sugars; minerals.

Proteids.—Muscle builder; blood builder; give force and heat.

Starches and sugars.—Convertible into heat and work; make fat.

Minerals.—Water is a solvent; salts; bone.

(One hour.)

(b) **DIGESTIVE APPARATUS**:

Mouth.—Mastication of food; mixing with saliva; no digestion except slight conversion of starch into sugar; saliva comes from salivary glands; parotid; submaxillary; sublingual; mumps.

Pharynx and esophagus.—For swallowing and conveying food to stomach.

Stomach.—Muscular bag; opens into small intestine.

Small intestine.—Five feet in length.

Vermiform appendix.

Rectum.

Anus.

(Two hours.)

(c) **OMENTUM**:

Umbilicus.—Location of; what for.

Gall bladder.—Location of; what for.

Gall.—What is it?

Sweetbread or pancreas.

Liver.—Function.

Spleen.—Function.

(One hour.)

V. THE BLOOD AND THE CIRCULATORY SYSTEM

(a) **LYMPHATIC AND BLOOD VESSEL SYSTEM**:

Lymph glands.—Inguinal; epitrochlear; post cervical.

Blood and blood vessels.—Functions, receive from lungs and alimentary tract, carry to the body materials for nutrition, temperature and moisture, carry away waste or poisonous matters; appearance and composition, red, bright red in arteries, dark red in veins, cells, liquor sanguinis.

(Three hours.)

Heart.—Cavities; arteries; capillaries; veins (draw a schematic diagram of blood circulation); aorta; innominate; left common carotid; left subclavian; carotid and right subclavian; brachial; radial; ulnar; common iliac; internal and external iliac; popliteal; anterior and posterior tibial (illustrate by showing where to make pressure for hemorrhages). (Three hours.)

VI. THE RESPIRATORY APPARATUS

RESPIRATORY APPARATUS.—Larynx or Adam's apple; epiglottis; trachea or windpipe; right and left bronchus; lungs; air cells; respiration; inspiration; expirational necessity of ventilation; sweat or perspiration.

(Two hours.)

VII. THE EXCRETORY APPARATUS

URINARY APPARATUS.—Kidneys; ureters; bladder; urethra.

(One hour.)

FIRST AID

I. EMERGENCIES, CONTUSIONS AND WOUNDS

(a) EMERGENCIES.—Bleeding; shock; wounds; fractures.

(b) CONTUSIONS.—"Subcutaneous wound"; symptoms; treatment; shock, symptoms and treatment.

(Eight hours.)

(c) WOUNDS.—Division of skin and tissue; classes, incised, lacerated, contused, punctured, poisoned, gunshot wounds; granulation; suppuration; inflammation; septic infection; treatment, arrest hemorrhage, relieve shock, prevent infection (first-aid packet); local wounds of skull, chest, abdomen, bladder; poisoned wounds; bites; rabies; tetanus; anthrax; poisoned arrows.

(Eight hours.)

The close contact of well constructed and protected opposing trenches, the development of the hand grenade, bomb, high-explosive shell, shrapnel, machine gun, and asphyxiating gas have all combined to greatly limit the usefulness of the rifle.

The use of the bayonet in carrying a position has been a weighty factor during the operations of the present war. The French bayonet, which is triangular on cross section, needle-pointed, fluted, and with one or more cutting edges, is considerably longer than any of the other bayonets. The English bayonet and that of the continental armies is a knife bayonet, which takes the form of their respective hunting knives.

Rifle balls.—There are a number of factors which have a bearing upon the character of the wound inflicted by the cylindro-ogival rifle ball, of which the German ball S is a type. If the soft parts only are involved, the wound of entrance and channel are of the same size as the undeformed bullet. At close range the wound of exit is larger. This is due to the inability of the tissues to spread or separate quickly enough to allow the high-velocity bullet to make a channel without pushing some of the tissue it traverses ahead of it, and only when compact bone is in its path does it cause comminution, and the smaller bony fragments act as secondary missiles.

Grenades.—They may be thrown by the hand or rifle. The German grenade is composed of a copped rod, to the extremity of which is fixed a cast-iron cylinder filled with a high explosive and grooved in order to facilitate breaking. It usually fires by percussion. By hand it is used for short distances; with the rifle it has a maximum range of 400 meters. Grenade wounds, besides the usual great destructive effects, are always infected wounds. The "minenwerfer," or trench mortar, first introduced by the Germans in the early fighting around Ypres, is another means of hurling a large amount of high explosive into an opposing trench. It throws a shell of about 180 pounds a distance of 350 yards.

The machine gun.—There is no difference in the actual effect of a ball from these and from the rifle.

Shrapnel.—Is being used less and less, the high-explosive shell being considered much more effective, both on account of effectively sweeping a larger area and on account of the fact that in the vicinity of the explosion air vibrations alone are sufficient to cause instant

death. The death from these shells, without any apparent wounds, has remained a mystery. It is probably due to the fact that in the immediate vicinity of the explosions there is a sudden atmospheric depression to the extent of about 350 millimeters of the mercury tube, corresponding to a dynamic pressure of about 10 tons to the square yard. The men exposed to this violent change meet with conditions similar to the men who leave compressed air chambers without taking the proper precautions, the effect being to liberate nitrogen suspended in the blood and to transform it into bubbles of gas. These are transferred by the action of the heart into the capillary vessels, stopping the circulation of the blood in the vital centers and causing instant death. On the other hand, some of the causes of these deaths, without apparent wounds, may be due to the blow the body receives from the primary violent air impact delivered as a blow over one side of the body and especially over the heart, causing reflex actions that register themselves with a fatal effect.

II. HEMORRHAGES

- (a) CAPILLARY HEMORRHAGE.—Treatment; nose bleed.
- (b) VENOUS HEMORRHAGE.—Treatment.
- (c) ARTERIAL HEMORRHAGE.—Character; treatment; points of pressure for different arteries; tourniquet; pads; bleeding from lungs, stomach, bowels—symptoms. Treatment—absolute quiet, cold applications.

III. DISLOCATIONS AND SPRAINS

- (a) DISLOCATIONS.—Definition “out of joint”; ligaments torn; cause; symptoms—deformity, shortening of limb, lack of movement (unnatural movement in fractures). Treatment—reduction, support. Special dislocations—shoulder, anterior and posterior dislocations of the thigh; symptoms, treatment, Kocher’s method, after-treatment; jaw, symptoms, treatment, after-treatment; finger joints, treatment; patella, symptoms, treatment.

(Two hours.)

- (b) SPRAINS.—Nature; symptoms; treatment; special sprain—ankle, symptoms, treatment, hot water, cleanse and strap, bandage, shoe, walking, massage.

IV. FRACTURES

- (a) FRACTURES.—Definition; classification—simple compound, comminuted, complicated, green stick; symptoms—loss of power, unnatural movement, crepitus, pain, swelling; treatment—put parts in place, hold them still with splints; setting; extension and counter-extension; bandages (not too tight), splints; purpose, kinds, extemporized splints; padding; support; “knitting” of bones. Effects of too tight bandaging on splints.

(Two hours.)

(b) SPECIAL FRACTURES:

- Skull*.—Cranium, base, special symptoms; special treatment.
- Spinal column*.—Special symptoms; special treatment.
- Ribs*.—Special symptoms; special treatment.
- Pelvis*.—Special symptoms; special treatment.
- Nose*.—Special symptoms; special treatment.
- Mandible*.—Special symptoms; special treatment.
- Clavicle*.—Special symptoms, attitude, special treatment, pad in axilla, Sayre’s strapping or Velpeau bandages.
- Humerus*.—Special symptoms; special treatment; slings, sling.
- Forearm*.—Special symptoms, special treatment, position of arm, splints, radius (Colles’s fracture), symptoms, put in sling, leave for surgeon.
- Metacarpals and fingers*.—Splints, bandage.
- Femur*.—Special symptoms—eversion, shortening, special treatment—setting, extension, counter-extension, splints and padding, method of application, splints tied in 5 places, tie legs together.
- Patella*.—Special symptoms; special treatment—splints, figure-of-eight bandages.
- Leg*.—Both bones, special treatment—splints.

Leg.—Both bones, special treatment—splints, tie legs together; fibula, Pott's fracture, special treatment—splints (2); tie legs together.

Foot.—Plaster of Paris dressing.

(Eight hours.)

V. FOREIGN BODIES

In the eye.—Eversion of lids, removal of object, use of burned match.

In the ear.—Animal or mineral, water and syringe; vegetable, use wire, keep end of it in sight; wax, use soda solution and syringe, alcohol and boric acid to dehydrate.

In the nose.—Treatment; maggots, treatment—chloroform followed by syringing with warm salt solution.

In the throat.—Use forceps or dry bread or induce vomiting.

In the air passages.—Mention tracheoscopy.

In the stomach.—Mention esophagoscope. Open operation; use of X ray.

In the skin.—Splinters; needles, fishhooks; gunpowder.

(One hour.)

VI. EFFECTS OF HEAT AND COLD

(a) HEAT:

Heat stroke.—Cause, contributing factors, symptoms, treatment, effects.

Heat exhaustion.—Symptoms, treatment.

Burns.—Degrees—first, redness; second, blisters; third, charring; symptoms—shock, chill, pain; dangers from burns of first, second, and third degrees; open treatment, paraffin wax R; treatment of first degree—soda, oil; of second and third degree—protection from air, prevention from infection, relief from shock, care of blisters; general treatment.

In the present war, flame projectors are used for throwing burning liquids or gases. The effective range is about 30 meters. The burns caused by this method are of the deep, sloughing variety, exposing tendons and bones, and are treated with wet dressings until healthy granulations appear. These flame projectors are mainly employed in street and house-to-house fighting, although they have been used in the trenches.

Burns from acids.—Treatment.

Burns from alkalis.—Treatment.

Clothing on fire.—Action to be taken.

(Four hours.)

(b) COLD:

Freezing.—Local effects; general effects; treatment—rubbing with cold cloths in cold room, artificial respiration, warm drinks when the patient can swallow.

Frost bite.—Nature; symptoms; danger; treatment.

Chilblain.—Nature, cause; symptoms; treatment; prevention—woolen socks.

(Four hours.)

VII. INSENSIBILITY

(a) *FAINTING.*—Cause—mental; contributing causes—bleeding; exhaustion; symptoms—skin, face, pupils, breathing; treatment—position clothing, stimulants.

(b) *SHOCK.*—Cause—physical; symptoms—skin, face, pupils, breathing, pulse, temperature; injuries causing it; treatment—local, stop hemorrhage, general warmth.

(Four hours.)

(c) *CONCUSSION OF BRAIN.*—Cause; nature; symptoms—mental, pupils, breathing, pulse, treatment—rest, warmth, ammonia.

(d) *COMPRESSION OF BRAIN.*—Cause; nature; apoplexy; some paralysis; treatment raise bone, stop bleeding.

(One hour.)

(e) *LIGHTNING STROKE.*—Effects; treatment—artificial respiration, symptomatic treatment. Electric shock—break the circuit, using dry clothes, stick or rope; treat as for lightning.

(f) *ACUTE ALCOHOLISM.*—Symptoms—mental, face, eyes, pupils, temperature, breathing, pulse, no paralysis (distinguish from apoplexy); treatment—induce vomiting, cold to head, warmth to body, warm drinks, sleep. Very important to distinguish from skull fracture.

(g) **EPILEPSY**.—Severe type; symptoms—cry, fall without knowing that he is falling, rigidity, convulsions, stupor, sleep, pupils, tongue, bladder, bowels, no paralysis; treatment—protect tongue by twisted handkerchief in mouth; feigned epilepsy; note time of occurrence, tongue not hurt in falling, pupils normal, eyeballs sensitive, soap in mouth, pail of water thrown on patient helps distinguish.

(One hour.)

(h) **UREMIC COMA**.—Distinguish from skull fracture.

(i) **OPIUM POISONING**.—Symptoms—mental, pupils, breathing, (8–10) pulse; treatment—induce vomiting, permanganate of potassium, coffee, pain, movement to prevent sleep.

(One-quarter hour.)

VIII. ASPHYXIA

ASPHYXIA.—Definition; modes of occurrence; treatment—removal of the cause, artificial respiration (Shafer's method) (have the class do it properly). Drowning; treatment—get rid of the water, artificial respiration, restore heat, stimulate circulation, prevent complications. (NOTE.—Only Schafer's method of artificial respiration correctly done will be used.)

(One-half hour.)

IX. POISONING

(a) POISONS TAKEN INTERNALLY:

General treatment.—Empty stomach; emetics—warm water, salt, mustard, tickle throat, wash stomach; antidotes given immediately after emetic—general, tea, milk, special, taken up later on; relieve pain—oils, milk, morphine; counteract lethal tendency—shock, stimulants, warmth, rubbing; failing heart—hot coffee, strychnine; failing respiration—coffee, cold douche, artificial respiration; convulsions—chloroform, bromides.

Summary.—If you do not know what poison: (1) If lips and mouth are burned, no emetics, olive oil, rest, morphine, mustard plaster over stomach, counteract symptoms. (2) If lips and mouth are not burned, emetic, three raw eggs, milk or flour and water, hot tea; rest, counteract symptoms. If you know the poison, emetic, appropriate antidote, relieve pain, counteract symptoms. (3) A good antidote, when in doubt, is Haines Universal Antidote, equal parts of heavy calcined magnesium oxide, animal charcoal, tannic acid. Keeps well when dry for a long time.

Classification.—Caustics: Symptoms—primary effects, remote effects; burns on lips, pain, bloody vomit, with shreds of stomach lining; treatment—no emetic, neutralize poison, acids or alkalis, protect mucosa by oils, milk, relieve pain, carbolic acid.

Irritants of alimentary canal: Arsenic, corrosive sublimate, etc. Primary and remote effects.

Neurotoxic, acting primarily on the central nervous system: Opium, strychnine, belladonna, atropine, phosphorus: primary and remote effects.

Asphyxiating gas, chlorine, or bromine gas, compressed to liquid form and liberated from large metal tanks when the wind is blowing toward an opposing trench, has caused very distressing deaths when inhaled in concentrated form. Being heavy gasses, they hug the ground, moving to leeward, and sink into the trenches, there causing a violent irritation of the bronchial tract, with a hypersecretion of a thin water mucus which fills up the air spaces of the lungs and practically causes death from drowning. The protection from this is the prophylaxis in the form of a protector helmet, with a solution of hyposulphite and bicarbonate of sodium. The only form of gas which the present British masks will not protect from is the poisonous carbon-monoxide. This is an active poison, and when it is inhaled it unites with the hemoglobin of the blood.

(Four hours).

Special poisons.—Carbolic acid; symptoms; treatment—sulphates, albumen, emetics; teach men that one emetic nearly always available when no others are at hand and almost always effective is tepid (not hot or cold) dish water; artificial respiration, warmth, rubbing.

Opium; symptoms; after effects; treatment—emetic, permanganate of potassium, coffee, prevent sleep.

Wood alcohol; symptoms; after effects; treatment—emetics, enema, strychnine, artificial respiration, warmth.

Ptomaines; nature, symptoms; treatment—emetics, cathartics, relieve pain, stimulants, warmth. Etiology—nearly always bacteriological.

Chloral—"knockout drops"; symptoms; treatment—emetics, strychnine, coffee, rest, prevent sleep.

Arsenic—"Paris green"; symptoms; treatment—emetics, freshly prepared iron hydrate (tincture of iron and dilute ammonia), morphine, warmth, rubbing, magnesium oxide.

Corrosive sublimate; symptoms; treatment—three raw eggs or milk, emetics later, morphine, bland drinks, warmth, rubbing.

Silver nitrate; treatment—salt and water, tickle throat.

Phosphorus (matches); antidote—potassium permanganate solution may be used.

Strychnine; symptoms; treatment—emetics, chloroform or bromides.

(Two hours.)

(b) EXTERNAL POISONS:

Special poisoning.

Poison ivy.—Three leaflets, hairy stem, white berries; symptoms; treatment—wash with alcohol, later with soda solution.

Poison oak.—Three leaflets notched, downy under surface; symptoms; treatment—wash with alcohol, later with soda solution.

Poison sumach.—White berries (ordinary sumach has red berries); symptoms; treatment—wash with alcohol, later with soda solution.

Snake bite.—Nature of venom, treatment, etc.

(One hour.)

NURSING

I. EXTERNAL POISONS

(As each is taken up, give examples of where they are used)

(a) HEAT.—(1) Dry heat—means, method of using, precautions. (2) Moist heat—poultices, methods of making and application; fomentations or stupes, methods of application; sweat tent. Method of testing temperature.

(b) COLD:

Compresses.—Method of making and application.

Ice bag.—Method of making and application.

Ice water coils.—Method of making and application.

(c) LOTIONS, MEDICATED (two hours).

(d) COUNTERIRRITANTS.—Indications and use:

Rubefacients.—Mustard plaster—method of making and application (no hot water or vinegar); turpentine stupes; iodine; liniments and massage; cupping dry and wet.

Blisters.—Cantharides, collodion, or plaster—method of application, chloroform or ammonia covered; actual cautery use.

Caustics.—Silver nitrate—before using, clean on wet lint. Copper sulphate—for application to eyelids, rub crystal on fine stone to produce fine point. Nitric acid—method of application; used for disinfecting chancreoids.

(Two hours.)

II. TEMPERATURE, PULSE, RESPIRATION

(a) TEMPERATURE.—Different at different times; limits.

Normal.—Method of taking—thermometer, self-registering maximum, Fahrenheit scale, method of standardizing; method of use.

Subnormal.—Cause.

Fever.—Danger point; moderate; high; very high; continued; remittent; intermittent. Fever charts.

(One hour.)

(b) PULSE.—Method of feeling; normal pulse—frequency, regularity, fullness, tension, strength, intermittence; effect of—food excitement, etc.; irritable; dirotic; intermittent (one hour).

(c) **RESPIRATION.**—Method of taking without knowledge of patient; normal rate; frequency; regularity; easy or difficult; quiet or noisy; deep or shallow; symmetrical. Slow and shallow in narcotic poisoning, etc. Rapid in pneumonia, peritonitis, etc. Cheyne-Stokes respiration; nature; occurs in heart and kidneys disease. "The lamp tends to flicker when going out." Stertorous breathing. Dyspnea. Relation of pulse, temperature and respiration (one hour).

III. BANDAGING

(a) **TRIANGULAR BANDAGE.**—Application.

(b) **ROLLER BANDAGES.**—Material sizes; preparation.

Rules for use.—(1) Limb in position it is to occupy; (2) begin at extremity of limb; (3) put a layer of cotton between opposed skin surfaces; (4) hold the roller in right hand to bind the left limb, and vice versa; (5) place the outer surface of bandage on inner side of limb and secure by two circular turns; (6) bandage evenly. Do not bandage too tight. (If the blood when pressed out from under nails does not promptly return, the bandage is too tight.)

Circular turns.—Spirals; reverses; figures-of-eight; spica; knotted turn.

Special application of roller bandages.—(1) Recurrent of head or stump; (2) figure-of-eight, of eye or jaw; (3) spiral of chest; (4) Velpeau for fractured clavicle; (5) finger bandages; (6) foot bandages.

(c) **TAILED BANDAGES.**

(d) **T BANDAGES.**

(e) **STERILE GAUZE BANDAGE.**

(f) **FLANNEL BANDAGE.**

(g) **RUBBER BANDAGES.**—Care; method of washing; method of application; use as a tourniquet.

(h) **PLASTER OF PARIS BANDAGE.**—Method of preparing; method of applying (strip of tin); method of removing.

(Two hours.)

HYGIENE

I. INFECTIOUS DISEASES

(Brief, general discussion of the bacteria. Avoid symptoms of diseases)

Typhoid fever.—Cause; dissemination—infected foods, polluted liquids, fecal matter and urine infection; always present in person of carriers (proportion of 1 to 1,000 in mobilization camps); contact infection—milk, food, flies (direct carriers and through fecal matter); prophylaxis, immunization; segregation; urine tubs.

Paratyphoid fever.—Take up under same heading as typhoid.

Diarrhea and dysentery.—Fifty-seven thousand two hundred and sixty-five deaths in the Federal armies; simple diarrhea, fermentative or putrefactive; amoebic dysentery; bacillary dysentery.

Cholera.—Method of transmission; prophylaxis (four hours).

Tuberculosis.—Everyone infected in childhood; acquired immunity; activity caused by breaking down of resistive power; mode of infection; prophylaxis—fresh air.

Pneumonia.—Avoid vitiated air. Best precaution good ventilation (two hours).

Malaria.—Results only from mosquito-bite method of infection—salivary glands; prophylaxis; destruction of mosquitoes; protection against bites; isolation and protection of malarial patients; medical prophylaxis.

Yellow fever.—Mosquito; prophylaxis.

Dengue.—Break-bone fever; mosquito (two hours).

Typhus fever.—Body louse—in clothing, not on person. Plague; *Pulex cheopis*—rat flea (two hours).

Spinal meningitis.—Transmission; prophylaxis (two hours).

Smallpox.—Transmission; prophylaxis.

Scarlet fever.—Transmission; prophylaxis.

Measles.—Transmission; prophylaxis.

Mumps.—Transmission; prophylaxis (two hours).

Tetanus or lockjaw.—Frequency in Europe; injections in first-aid stations of all wounded; transmission; prophylaxis.

Gas gangrene.—Frequency; cause; prophylaxis (four hours).

Bubonic plague.—Rat; rat flea.

Intestinal parasites.—Brief discussion of teniacycle and prophylaxis.

Skin parasites.—Barbers' itch; dhobie itch (two hours).

Relation of insects to infection.—Flies, fleas, mosquitoes, lice, ticks (two hours).

II. DISEASES CAUSED BY IMMORAL OR INTEMPERATE HABITS

Veneral diseases.—Gonorrhea; syphilis—stages of, with brief talk of remote effects; chancroid; transmission. Prophylaxis: (1) Moral teaching, the fundamental teaching of all home and school education; (2) sexual intercourse is not necessary to attain the best physical and mental health and that a strong manly character is developed only by self-control and continence. Appreciation of the prevalence and gravity of venereal diseases is essential. One-third of all prostitutes are suffering from some form of them in the infectious stage. Thirty-three per cent of all syphilitics eventually die of tuberculosis, paralysis, or aortic aneurysm. (Explain terms used.) The sinister predilection of tertiary syphilis for the nervous system is well known. Avoid thoughtless exposure; a few days in the hospital will not suffice to cure the disease. Syphilis affects not only the incontinent, but through matrimony many innocent women and children. Speak of the far-reaching effects on female genital organs. (3) All efforts to abolish prostitution have been futile. The strong hand of the military should be exerted to protect camps and garrisoned cities. (4) The life of the soldier in the garrison and camp should be made as attractive as possible. Post exchange with recreation features should be provided. (5) Systematic physical inspection of the men. Men found suffering from some venereal disease should be treated and strictly confined to their post. (6) Men contracting any form of disease after sexual intercourse should report as soon as first symptoms manifest themselves, so that they can be treated before complications arise. (7) Personal prophylaxis is not only advisable but also desirable, inasmuch as the influence of fear is a factor of slight importance in deterring.

Place special stress on (1) moral aspects, (2) continence, (3) venereal prophylaxis, (a) reasons for, (b) how it prevents, (c) time limit for use (six hours).

III. PERSONAL HYGIENE

Bathe and wash the skin.—(1) To promote and stimulate its functions; discuss. (2) To remove dirt and prevent the breeding of germs on its surface. (3) To prevent the fouling of the air by emanations; discuss. (4) For the tonic stimulating effects which cold water produces.

Daily toilet.—Wash face, neck, head, and hands and arms each morning. Do not use soap on the scalp more than twice weekly. Wash hands whenever soiled, before meals. Use neutral soap; explain. The teeth demand special attention. Nostrils. Ears. Hair. Feet, wash daily on the march. Drinking cup, danger of common cup. Baths at least twice weekly. Must wash hands after each visit to the latrine (four hours).

IV. WATER

Rain, river, lake, and spring. Hard and soft water—what is meant.

V. WATER PURIFICATION

Heat; chloride of lime; water filtration; calcium (or sodium) hypochlorite (1 hour).

VI. FIELD COOKING AND BAKING

The lecture will be illustrated by the preparation of one of several components of the rations on the field range (four hours).

VII. CLOTHING AND UNIFORM

Permeability—discuss; hygroscopicity; discuss advantages of wool; heat absorption; colors; head radiation; heat conductivity; evaporation (one hour).

VIII. EQUIPMENT

General requirements.—(1) Minimum weight; (2) proper suspension and distribution; (3) facility of putting on and removing; (4) easy segregation and removal of unnecessary parts for fighting and marching; (5) simplicity of construction and ease of repair; (6) sanitary construction. Illustrate with soldier in full pack with new equipment (two hours).

IX. AIR

Composition—oxygen, nitrogen, argon. Oxygen indispensable to the maintenance of life. Nitrogen inert gas.

X. VENTILATION

Cause of air contamination; dust; nature of ventilation; natural ventilation—diffusion of gases, action of wind, and thermal circulation; artificial ventilation (very brief); relation of bad ventilation in barracks to disease among soldiers (one hour).

XI. EXCRETA, GARBAGE, AND WASTE

Latrines.—Construction of; reasons for; types—trenches; latrine box; police and disinfection of each; sites, relation to civil population. Illustrate types of latrine by schematic drawings and construction (three hours).

Final disposition of feces and garbage.—(1) Discharge into sea, lake, or river; (2) biological treatment; (3) local treatment: (a) Incinerators, types, construction of; reasons for (take this up first); (b) dead animals (two hours).

XII. SOILS

Ground air (brief).

Ground moisture (brief).

Ground temperature (brief).

Influence of vegetation in soil.

Pollution and soil bacteria.

(One hour.)

XIII. CAMPS

Selection of site.—Soil; vegetation; exposures; wood; water; grass; poisonous plants; venomous animals (one hour).

Tents.—Shelter; wall; pyramidal; hospital; illustrate by pitching or seeing pitched (seven hours).

Form of camp.—Make schematic drawing on board of camp of unit or detachment (one hour).

XIV. DISINFECTION AND DISINFECTANTS

Air and light.

Heat.—Steam; dry.

Chemical disinfectants.—Gases—chlorin, SO_2 , formaldehyde, paraform.

Disinfecting agents in solution or powder.—Bichloride of mercury; mineral acids; formalin; carbolic acid; cresols; chloride of lime; quicklime.

(Two hours.)

XV. GENERAL SANITARY RULES

(1) Food—sufficient, wholesome, varied, well cooked.

(2) Prohibit sale of food and drinks by hucksters; no food in tents.

(3) Prevent contamination of water supply.

(4) Great concentration of troops should be avoided.

(5) Personal hygiene; cleanliness of body and clothing; fight with empty bowels and bladder.

(6) Latrines.

(7) Do not forget the rôle of flies and mosquitoes in transmission of disease.

(8) Cleaning, policing, and disinfection of camp grounds.

(9) Move camp location if practicable.

(Eight hours.)

XVI.

Model sanitary divisional order (see General Order No. 7, headquarters 89th Division, September 11, 1917).

XVII.

Work in orthopedics.—Care of feet. (One hour once a month under the direction of the orthopedic surgeon; three hours.)

Schedule of training for enlisted men, Medical Department

	Thursday, Nov. 1	Friday, Nov. 2	Saturday, Nov. 3	Monday, Nov. 5	Tuesday, Nov. 6	Wednesday, Nov. 7	Thursday, Nov. 8	Friday, Nov. 9
7.45 to 8.30 a. m.	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds
8.40 to 9.25 a. m.	Drill, school of soldier, etc.	Drill, school of soldier, etc.	Inspection	Drill	Drill	Drill	Drill	Drill
9.40 to 10.25 a. m.	Drill, school of detachment, etc.	Drill, school of detachment, etc.	Drill or inspection	Drill	Drill	Drill	Drill	Drill
10.35 to 11.20 a. m.	Anatomy: Bones (lectures must follow the outline)	Anatomy: Bones	Anatomy: Bones	Anatomy: Bones	Anatomy: Joints	Anatomy: Joints	Anatomy: Joints	Anatomy: Joints
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers (early lectures on venereal diseases to the men). Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects							
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	First-aid packet: Emergencies and contusions	First-aid packet: Wounds	No instruction	First aid: Capillary, venous, and arterial hemorrhage	First-aid packet: Sprains and dislocations	First aid: Fractures, definitions, and general consideration	First aid: Fractures, definitions, and general consideration	First aid: Special fractures
2.25 to 3.10 p. m.	Venereal diseases: Contingency dangers, prophylaxis, General Orders No. 31	Venereal diseases: Contingency dangers, prophylaxis, General Orders No. 31	No instruction	Personal hygiene: Bathing, daily toilet	Personal hygiene: Bathing, daily toilet	Personal hygiene: Bathing, daily toilet	Water and purification	Read and explain General Order No. 7, Headquarters 84th Division, Sept. 11, 1917
3.20 to 4.05 p. m.	Field Service Regulations	Field Service Regulations	No instruction	Field Service Regulations	Field Service Regulations	Field Service Regulations	Field Service Regulations	Field Service Regulations
4.15 to 5 p. m.	Customs of the service by lectures and quizzes	Wounds: First-aid packet	No instruction	The first-aid packet. A feature and demonstration; its use in the field	Nursing: Foreign bodies	Sanitation: quarters and grounds	Sanitation: Quarters and grounds	Special fractures as taken up in the outline of instruction

	Saturday, Nov. 10	Sunday, Nov. 12	Tuesday, Nov. 13	Wednesday, Nov. 14	Thursday, Nov. 15	Friday, Nov. 16	Saturday, Nov. 17	Monday, Nov. 19
7.45 to 8.30 a. m.	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds
8.40 to 9.25 a. m.	Inspection	Drill	Drill	Litter drill	Litter drill	Litter drill	Inspection	Drill
9.40 to 10.25 a. m.	Drill or inspection	Drill	Drill	Litter drill	Litter drill	Litter drill or inspection	Litter drill	Drill
10.35 to 11.20 a. m.	Anatomy: Muscles	Anatomy: Muscles	Anatomy: Cellular tissue and skin	Anatomy: The nervous system	Anatomy: The nervous system	Physiology: Foods	Physiology: Digestive apparatus	Physiology: Digestive apparatus
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers (early lectures on venereal diseases to the men). Separate instruction for carriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects.							
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	No instruction	First aid: Special fractures—as taken up in the outline of instruction					No instruction	Pitching of hospital tentage carried out in the sanitary train
2.25 to 3.10 p. m.	No instruction	Army Regulations: The especially important articles are arts. 19, 20, 21, 22, 30, 33, 40, 53, 73, and 74. Taken up in these and subsequent periods.					No instruction	Pitching of hospital tentage carried out in the sanitary train
3.20 to 4.05 p. m.	No instruction	Army Regulations	Army Regulations	Orthopedics: Footwear and the care of the feet	Pitching of shelter tents, if available	Pitching of pyramidal tentage, if available	No instruction	Army Regulations
4.15 to 5 p. m.	No instruction	The rights and duties of a soldier; lectures and quizzes	The rights and duties of a soldier; lectures and quizzes	Field Service Regulations	Pitching of shelter tents, if available	Pitching of pyramidal tents, if available	No instruction	Rights and duties of a soldier

Schedule of training for enlisted men, Medical Department—Continued

	Tuesday, Nov. 20	Wednesday, Nov. 21	Thursday, Nov. 22	Friday, Nov. 23	Saturday, Nov. 24	Monday, Nov. 26	Tuesday, Nov. 27	Wednesday, Nov. 28
7.45 to 8.30 a. m.	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds	Policing, setting up, march to drill grounds
8.40 to 9.25 a. m.	Drill, litter carrying	Drill	Drill	Drill, litter and carrying	Inspection	Drill	Litter and carrying drill	Drill
9.40 to 10.25 a. m.	Drill, litter carrying	Drill	Drill	Drill	Drill or inspection	Drill	Litter and carrying drill	Drill
10.35 to 11.20 a. m.	Physiology: Omentum and abdominal viscera	Physiology: Vascular and lymphatic system	Physiology: Vascular and lymphatic system	Physiology: The heart	Physiology: Respiratory system	Physiology: Respiratory system	Physiology of excretory apparatus	Nursing: External applications; heat and cold
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers (early lectures on venereal diseases to the men). Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects.							
	Mess	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Nursing: Heat, its effects, uses, etc.		Nursing: Heat, its effects, uses, etc.		No instruction	Nursing: Cold—its effects, uses, etc.	Nursing: Cold—its effects, uses, etc., must follow outline	Nursing: Cold—its effects, uses, etc., must follow outline
2.25 to 3.10 p. m.	Field cooking and baking	Field cooking and baking	Army Regulations	Army Regulations	No instruction	Nursing: Cold—its effects, uses, etc.	Soils: Outline of instruction	Army Regulations
3.20 to 4.05 p. m.	Field cooking and baking	Field cooking and baking	Open	Open	No instruction	Open	Diseases common on the Western Front	Diseases common on the Western Front
4.15 to 5 p. m.	Open	Open	Army Regulations	Open	No instruction	Open	Open	Open

	Thursday, Nov. 29	Friday, Nov. 30	Saturday, Dec. 1	Monday, Dec. 3	Tuesday, Dec. 4	Wednesday, Dec. 5	Thursday, Dec. 6
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Ambulance drill	Litter drill	Inspection and drill	Drill	Litter drill	Inspection or drill	Ambulance drill
9.40 to 10.25 a. m.	Ambulance drill	Litter drill	Drill	Drill	Litter drill	Inspection or drill	Ambulance drill
10.35 to 11.20 a. m.	Nursing: Cold applications; lotions	Nursing: Counterirritants; rubefacients; blisters; caustics	Nursing: Counterirritants; rubefacients; blisters; caustics	Nursing: Temperature	Nursing: Pulse	Nursing: Respiration	Nursing: Triangular bandage; roller bandage; circular turns; reverses; special applications
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers. Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects						
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Nursing: Fainting	Nursing: Shock	No instruction	Nursing: Shock	Nursing: Concussion and compression of the brain; lightning stroke	Nursing: Acute alcoholism; epilepsy; uremic coma	Nursing: Opium poisoning (15 minutes); asphyxia (30 minutes)
2.25 to 3.10 p. m.	Nursing: Shock	Army Regulations	No instruction	Disinfection and disinfectants	Disinfection and disinfectants	Army Regulations	Manual of the Medical Department, pars. 33 to 51
3.20 to 4.05 p. m.	Army Regulations	Open	No instruction	Customs of the service	Open	Open	Open
4.15 to 5 p. m.	Open	Open	No instruction	Open	Open	Open	Open

Schedule of training for enlisted men, Medical Department—Continued

	Friday, Dec. 7	Saturday, Dec. 8	Monday, Dec. 10	Tuesday, Dec. 11	Wednesday, Dec. 12	Thursday, Dec. 13	Friday, Dec. 14
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Litter drill	Inspection and drill	Drill	Litter and carrying drill	Ambulance drill	Inspection or drill	Litter or carrying drill
9.40 to 10.25 a. m.	Litter drill	Inspection and drill	Drill	Litter and carrying drill	Ambulance drill	Inspection or drill	Litter or carrying drill
10.35 to 11.20 a. m.	Nursing: Tailed and T bandages; sterile gauze and flannel bandages; rubber and plaster of Paris bandages	Infectious diseases: Typhoid fever	Infectious diseases: Paratyphoid fever	Infectious diseases: Dysentery	Infectious diseases: Cholera	Infectious diseases: Tuberculosis	Infectious diseases: Pneumonia
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers. Separate instruction for barriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects						
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Poisons: Classification of poisons taken internally	No instruction	Trench system; demonstration of; bombproofs; dugouts; abatis, etc.	Nursing: Poisons—classification of poisons; taken internally; special poisons	Nursing: Poisons—classification of poisons; taken internally; special poisons	Nursing: Poisons—classification of poisons; taken internally; special poisons	Nursing: Poisons—classification of poisons; taken internally; special poisons
2.25 to 3.10 p. m.	Poisons: Classification of poisons taken internally	No instruction	Trench system; demonstration of; bombproofs; dugouts; abatis, etc.	Manual of the Medical Department, especially parts 33 to 51, 205 to 282, 398 to 406, 427 to 465, 651 to 751. In the periods allotted to this subject			
3.20 to 4.05 p. m.	Open	No instruction	Trench system; demonstration of; bombproofs; dugouts; abatis, etc.	Orthopedics: Footwear and care of the foot	The Rules of Land Warfare	The Rules of Land Warfare	The Geneva and Hague conventions
4.15 to 5 p. m.	Open	No instruction	Open	Open	Open	Open	Open

Schedule of training for enlisted men, Medical Department—Continued

	Wednesday, Jan. 2	Thursday, Jan. 3	Friday, Jan. 4	Saturday, Jan. 5	Monday, Jan. 7	Tuesday, Jan. 8	Wednesday, Jan. 9
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Inspection or drill	Drill	Ambulance drill	Inspection and drill	Drill	Litter drill	Drill
9.40 to 10.25 a. m.	Drill or inspection	Inspection or drill	Ambulance drill	Inspection and drill	Drill	Litter drill	Drill
10.35 to 11.20 a. m.	Relation of insects to infection	Relation of insects to infection	Gonorrhea, syphilis, and chancreoid; moral aspects and continence; dangers and prophylaxis				
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers. Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects						
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	General sanitary rules and review	General sanitary rules and review	General sanitary rules and review	No instruction	General sanitary rules and review; consult outline	General sanitary rules and review; consult outline	General sanitary rules and review; consult outline
2.25 to 3.10 p. m.	Open	Open	Organizations, functions, and limitations of the American Red Cross	No instruction	Open	Open	Open
3.20 to 4.05 p. m.	Open	Open	Open	No instruction	Open	Open	Open
4.15 to 5 p. m.	Open	Open	Open	No instruction	Open	Open	Open

Thursday, Jan. 10	Friday, Jan. 11	Saturday, Jan. 12	Sunday, Jan. 13	Monday, Jan. 14	Tuesday, Jan. 15	Wednesday, Jan. 16	Thursday, Jan. 17
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Ambulance drill	Inspection and litter drill	Drill	Drill	Carrying and litter drill	Drill or inspection	Ambulance drill
9.40 to 10.25 a. m.	Ambulance drill	Drill	Drill	Drill	Carrying and litter drill	Drill	Ambulance drill
10.35 to 11.20 a. m.	Open	Open	Open	Open	Open	Open	Open
Special school for noncommissioned officers. Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks, and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects							
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Open	General sanitary rules and review; consult outline	No instruction	Open	Open	Open	Open
2.25 to 3.10 p. m.	Open	Open	No instruction	Orthopedics: Footwear and care of the feet	Open	Open	Open
3.20 to 4.05 p. m.	Open	Open	No instruction	Open	Open	Open	Open
4.15 to 5 p. m.	Open	Open	No instruction	Open	Open	Open	Open

Schedule of training for enlisted men, Medical Department—Continued

	Friday, Jan. 18	Saturday, Jan. 19	Monday, Jan. 21	Tuesday, Jan. 22	Wednesday, Jan. 23	Thursday, Jan. 24	Friday, Jan. 25
7.45 to 8.30 a. m.	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds	Policing, setting up, march to the drill grounds
8.40 to 9.25 a. m.	Drill	Inspection and drill	Drill	Litter drill	Drill	Ambulance drill	Drill
9.40 to 10.25 a. m.	Drill	Drill	Drill	Litter drill	Inspection or drill	Ambulance drill	Drill
10.35 to 11.20 a. m.	Open	Open	Open	Open	Open	Open	Open
11.30 a. m. to 12.15 p. m.	Special school for noncommissioned officers. Separate instruction for farriers, saddlers, blacksmiths, nurses, dispensary assistants, surgical assistants, ward masters, cooks and chauffeurs will be conducted during this hour by the various units using these types of men. Other men can receive instruction during this hour every day in the various military subjects						
	Mess	Mess	Mess	Mess	Mess	Mess	Mess
1.30 to 2.15 p. m.	Open	No instruction	Open	Open	Open	Open	Open
2.25 to 3.10 p. m.	Open	No instruction	Open	Open	Open	Open	Open
3.20 to 4.05 p. m.	Open	No instruction	Open	Open	Open	Open	Open
4.15 to 5 p. m.	Open	No instruction	Open	Open	Open	Open	Open

TRAINING FOR DENTAL CORPS

The personnel of the Dental Corps received its basic training in conjunction with the personnel of the Medical Department as a whole. The program for the professional training of dental officers in the subjects pertaining to that corps was prepared under the direction of the division surgeon by the supervising dental surgeon of the camp, and he was held responsible for this special training not only of personnel of the division but for all dental officers of the camps.¹⁵

TRAINING FOR VETERINARY CORPS

One of the general duties of veterinary officers during the World War was the training of personnel under their command with regard to their professional and military duties and responsibilities.¹⁶ Prior to February, 1918, a number of division veterinarians organized schools of instruction for veterinary personnel. In some instances these were included in the general scheme of divisional schools.¹⁷ An example of the work given in this period is found in the course of instruction for veterinary officers and enlisted men of the 40th Division, Camp Kearny, Calif. This course covered a period of 6 weeks, with a minimum requirement of 28 hours' intensive and thorough training. The course in the use of arms was not given because arms were not available.¹⁷

OFFICE OF THE DIVISION VETERINARIAN,
40TH DIVISION,
Camp Kearny, Calif., January 26, 1918.

The following schedule of training in the Veterinary Corps of the 40th Division is hereby announced:

* * * * *

This course is to cover a period of six weeks, with the minimum requirement each week of 28 hours intensive and thorough training.

OUTLINE OF INSTRUCTION

STABLE MANAGEMENT

The men are not to be used for stable police or as general grooms. However, proper and thorough grooming is to be taught in detail.

Stable management is to be given in five lectures.

Lecture 1:

- (a) Intent of grooming.
- (b) Structure and function of the skin.
- (c) Grooming utensils, their use and abuse.
- (d) Wisps, how to make and use.

Lecture 2:

- (a) Sponges, use and abuse.
- (b) Use of thorough grooming and massage, in helping to keep sick animals fit.
- (c) Routine of grooming—cleaning of various parts, as body, limbs, head, mane, and tail.
- (d) Cleaning the hoof.
- (e) Cleaning the sheath.
- (f) How to deal with wet and muddy horses.

Lecture 3:

- (a) Hygiene of the picket line and stall.
- (b) Mucking out.
- (c) Bedding down.
- (d) Picket-line burning.
- (e) Drainage.
- (f) Ventilation in detail.

Lecture 4:

- (a) Clothing and bandages for warmth and their proper application.
- (b) Clipping—when, how, and why done; advantages and disadvantages.

Lecture 5:

- (a) Exercise—
 1. Its necessity in order to maintain health.
 2. Bearing on condition, grooming, and cleanliness.
- (b) Proper methods for securing animals on the picket line and in the stable.

FEEDS, FEEDING, AND WATERING (TO BE GIVEN IN FIVE LECTURES)

Lecture 1: (a) Anatomy of the digestive organs.

Lecture 2: (a) Physiology of the digestive organs.

Lecture 3:

- (a) Teeth, care and importance.
- (b) Relation of amount and kind of food for work demanded.
- (c) Kinds of forage, amounts usually given, ratios for various classes of animals at rest and at work.
- (d) Proper storage of forage.

Lecture 4:

- (a) Nosebag feeding; care of nosebag; dangers.
- (b) Making bran mashes.
- (c) Use of green feed.

Lecture 5:

- (a) Care of feed boxes and mangers.
- (b) Watering—
 1. Kinds of water,
 2. Source of dangers.
 3. Care of watering troughs.
- (c) Salt.

SCHOOL OF THE TROOPER

Will use Cavalry Drill Regulations, both dismounted and mounted drills, giving particular attention to squad drill, omitting rifle and saber drills, but including pistol drill.

HANDLING ANIMALS AND OTHER POINTS (TO BE GIVEN IN FIVE LECTURES)

Lecture 1:

- (a) How to trot a led horse properly.
- (b) Restraint—
 1. Use of stocks, switches, and blinds.
 2. Casting—use and abuse. Casting rope or harness, hobbles, casting for operation, fixation of limbs when cast.
 3. Speculum—examining and floating the teeth.

Lecture 2:

- (a) Passing catheter (mare and horse).
- (b) Passing stomach tube (orally and by the nares).
- (c) Giving inhalations.
- (d) Giving enemata.

Lecture 3:

- (a) Balling.
- (b) Drenching—bottle and dose syringe; dangers.
- (c) Application of tourniquet.
- (d) Blistering and fiding.

Lecture 4:

- (a) Preparation of the field of operation.
- (b) Poulticing.
- (c) Liniments and other external remedies.
- (d) Fomentations of the limbs, chest, belly, and precautions to be taken to avoid chills subsequently.

Lecture 5: (a) Bandaging—

1. Making and application of all kinds for warmth, exercise, or surgical use.
2. The bandaging of wounds, joints, and swellings; when and how such should be employed or avoided.
3. Pressure bandages, hot and cold bandages, cloths, and rugs.

ARMY REGULATIONS

1. Should not neglect "honors, courtesies, ceremonies, etc."
2. This instruction should also include the major and important regulations applicable.

CARE OF THE SICK AND INJURED (TO BE GIVEN IN FIVE LECTURES)

Lecture 1:

- (a) Teach routine of observation of cases—
 1. Respiration—number per minute, quality, significance.
 2. Pulse—number per minute, quality.
 3. Temperature—normal. Thermometry.
 4. Skin, appetite, feces, urine, etc.
- (b) Attention to watering and feeding sick animals.
- (c) Provision of head rests when necessary.
- (d) Ventilation without drafts.
- (e) Cleanliness of bedding.

Lecture 2:

- (a) Slings—use, how to be applied, cleaning, prevention of slipping.
- (b) Ambulances—moving horses into and out of.
- (c) Care of horses down and unable to rise—
 1. Frequent turning and how to do it.
 2. Care of bedding to prevent bed sores.
 3. Attention to bowels and urine when down.
- (d) Cast horses, assisting to rise.

Lecture 3:

- (a) Control of hemorrhages; tourniquet, ligature, bandaging, packs, cautery, forceps, medicinal, etc.
- (b) Destruction of animals, humanely and quickly.

Lecture 4:

- (a) Skin cases—washing, dressing, and clothing.
- (b) Dressing of wounds—cleanliness, antiseptics, etc.

Lecture 5:

- (a) Lameness—noting alterations of positions.
- (b) Colics—
 1. Use of walking exercises, enemata, and belly fomentations.
 2. Value of recording state of pulse and mouth at intervals.
 3. Rectal examination—dangers.
 4. Routine emergency treatment and after treatment.
 5. Prevention.

METROLOGY: MEASURES OF MASS, CAPACITY, LINEAR MEASURE, AND HEAT (TO BE GIVEN IN FIVE LECTURES)

Lecture 1: (a) Metric system—

1. Derivation of units.
2. Tables.

Lecture 2:

- (a) Avoirdupois system.
- (b) Apothecaries' system—
 1. Weight.
 2. Capacity.

Lecture 3:

- (a) Linear systems in common use.
- (b) Domestic measures.

Lecture 4:

- (a) Review of lectures 1, 2, and 3.
- (b) Thermometers—

I. Changing between centigrade and Fahrenheit.

Lecture 5: (a) Transposing between different systems respective of mass, capacity, and linear.

MEDICINAL AGENTS (TO BE GIVEN IN FIVE LECTURES)

Lecture 1:

- (a) Drugs, use and abuse.
- (b) Those in common use, actions, dosage.

Lecture 2: (a) Drugs in common use, dosage, continuation of lecture 1.

Lecture 3: (a) Poisons, dangerous dosage, antidotes.

Lecture 4: (a) Preparations used in emergency treatments.

Lecture 5: (a) Administration of medicines.

DISINFECTION (TO BE GIVEN IN TWO LECTURES)

Lecture 1:

- (a) Explanation of terms; disinfectant, antiseptic, contagion, infection, absolute cleanliness, fumigation.
- (b) Details of disinfection of buildings, yards, cars, and ships.

Lecture 2:

- (a) Official disinfectants.
- (b) Strengths and how used.
- (c) How to make different percentage solutions.

FIRST AID TO THE SICK AND INJURED (TO BE GIVEN IN THREE LECTURES)

Lecture 1: (a) Wounds; varieties and emergency treatments.

Lecture 2: (a) Continuation of lecture 1.

Lecture 3: (a) Contagious diseases; described, precautions, methods of dealing with outbreaks, with reasons for each.

THE FOOT AND SHOEING (TO BE GIVEN IN FIVE LECTURES)

Lecture 1: (a) Anatomy of the foot (demonstrate).

Lecture 2:

- (a) Physiology of the foot.
- (b) Pathology of the foot.

Lecture 3: (a) Principles of shoeing.

Lecture 4: (a) Accidents and minor diseases of the foot and their first-aid treatment.

Lecture 5: (a) Examination of the foot.

MANAGEMENT OF ANIMALS (TO BE GIVEN IN FOUR LECTURES)

Lectures 1 and 2: (a) On the march and in camp—

1. Feeding and watering.
2. Protection from weather, clothing.
3. Sanitation of lines and camp.
4. Picketing.
5. Marching of such sick or injured animals as is necessitated.

Lecture 3: (a) On shipboard—

1. Preparation and care of animals during voyage.
2. Feeding and watering.
3. Shipboard sanitation.
4. Exercise.
5. Slings and other modes of embarking and disembarking, how to swim horses.
6. Diseases.

Lecture 4: (a) In the hospital.

PAPER WORK (TO BE GIVEN IN THREE LECTURES)

Lecture 1:

- (a) Letter writing (comp. gen. orders).
- (b) Requisitions.
- (c) Returns.

Lecture 2:

- (a) Descriptive lists of animals.
- (b) I. and I. report.
- (c) Certificates.
- (d) Affidavits.

Lecture 3:

- (a) Clinic daybook.
- (b) Ledger.

NECROPSIES (TO BE GIVEN IN ONE LECTURE)

Lecture 1:

- (a) Precautions.
- (b) Methods of making post-mortem examinations.

DISPOSAL OF CARCASSES (TO BE GIVEN IN ONE LECTURE)

Lecture 1:

- (a) Cremation—cross trench and other systems.
- (b) Burial—dangers of, proper methods.
- (c) Food carcasses—meat inspection.

OPERATIONS (TO BE GIVEN IN ONE LECTURE)

Lecture 1:

- (a) Assistance at.
- (b) Administration of anesthetics.
- (c) Aftercare.

VETERINARY EQUIPMENT (TO BE GIVEN IN TWO LECTURES)

Lecture 1:

- (a) Care.
- (b) Packing and unpacking.

Lecture 2: (a) Pack mule transportation (instruction, with demonstrations, in packing veterinary equipment).

ANATOMY (TO BE GIVEN IN SIX LECTURES)

Lectures 1 to 6, inclusive: Elementary structure of the various organs and parts.

PHYSIOLOGY (TO BE GIVEN IN SIX LECTURES)

Lectures 1 to 6, inclusive: Functions of the various organs and parts.

PARASITES AND PARASITIC CONDITIONS (TO BE GIVEN IN FIVE LECTURES)

Lectures 1 to 5, inclusive:

- (a) Transmission of disease.
- (b) Common parasites.
- (c) Life histories.
- (d) Recognition.
- (e) Prevention.
- (f) Economic importance.
- (g) Control.

SCHEDULE OF INSTRUCTION

FIRST WEEK

Monday:

- 6 to 6.20 a. m.----- Physical drill.
- 7.45 to 9.15 a. m.----- Stable management.
- 9.15 to 11.30 a. m.----- Feeds, feeding, and watering.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Articles of War.

Tuesday:

- 6 to 6.20 a. m.----- Physical drill.
- 7.45 to 9.15 a. m.----- Stable management.
- 9.15 to 11.30 a. m.----- Feeds, feeding, and watering.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Articles of War.

Wednesday:

- 6 to 6.20 a. m.----- Physical drill.
- 7.45 to 9.15 a. m.----- Stable management.
- 9.15 to 11.30 a. m.----- Feeds, feeding, and watering.
- Half holiday.

Thursday:

- 6 to 6.20 a. m.----- Physical drill.
- 9.15 to 11.30 a. m.----- Feeds, feeding, and watering.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Army Regulations.

Friday:

- 6 to 6.20 a. m.----- Physical drill.
- 7.45 to 9.15 a. m.----- Stable management.
- 9.15 to 11.30 a. m.----- Feeds, feeding, and watering.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Army Regulations.

Saturday:

- 6 to 6.20 a. m.----- Physical drill.
- 8.20 a. m.----- Inspection.
- Half holiday.

SECOND WEEK

Monday:

- 6 to 6.20 a. m.----- Physical drill.
- 7.45 to 9.15 a. m.----- Handling animals, and their points.
- 9.15 to 11.30 a. m.----- Care of the sick and injured.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Army Regulations.

Tuesday:

- 6 to 6.20 a. m.----- Physical exercises.
- 7.45 to 9.15 a. m.----- Handling animals, and their points.
- 9.15 to 11.30 a. m.----- Care of the sick and injured.
- 1 to 2 p. m.----- School of the trooper.
- 2 to 3 p. m.----- Army Regulations.

Wednesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Handling animals, and their points.
9.15 to 11.30 a. m.-----	Care of the sick and injured.
Half holiday.	

Thursday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Handling animals, and their points.
9.15 to 11.30 a. m.-----	Care of the sick and injured.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Army Regulations.

Friday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Handling animals, and their points.
9.15 to 11.30 a. m.-----	Care of the sick and injured.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Army Regulations.

Saturday:

6 to 6.20 a. m.-----	Physical exercises.
8.20 a. m.-----	Inspection.
Half holiday.	

THIRD WEEK

Monday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Metrology.
9.15 to 11.30 a. m.-----	Medicinal agents.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Tent-pitching drills.

Tuesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Metrology.
9.15 to 11.30 a. m.-----	Medicinal agents.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Tent-pitching drills.

Wednesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Metrology.
9.15 to 11.30 a. m.-----	Medicinal agents.
Half holiday.	

Thursday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Metrology.
9.15 to 11.30 a. m.-----	Medicinal agents.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Tent sanitation.

Friday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Metrology.
9.15 to 11.30 a. m.-----	Medicinal agents.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Personal hygiene.

Saturday:

6 to 6.20 a. m.-----	Physical exercises.
8.20 a. m.-----	Inspection.
Half holiday.	

FOURTH WEEK

Monday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Disinfection.
9.15 to 11.30 a. m.-----	First aid.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Veterinary Corps, organization and personnel.

Tuesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Disinfection.
9.15 to 11.30 a. m.-----	First aid.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Paper work.

Wednesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	First aid.
9.15 to 11.30 a. m.-----	The foot and shoeing.
Half holiday.	

Thursday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	The foot and shoeing.
9.15 to 11.30 a. m.-----	Management of animals.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Paper work.

Friday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	The foot and shoeing.
9.15 to 11.30 a. m.-----	Management of animals.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Paper work.

Saturday:

6 to 6.20 a. m.-----	Physical exercises.
8.20 a. m.-----	Inspection.
Half holiday.	

FIFTH WEEK

Monday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	The foot and shoeing.
9.15 to 11.30 a. m.-----	Management of animals.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Tuesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	The foot and shoeing.
9.15 to 11.30 a. m.-----	Management of animals.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Wednesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Necropsies.
9.15 to 11.30 a. m.-----	Disposal of carcasses.
Half holiday.	

Thursday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Operations.
9.15 to 11.30 a. m.-----	Veterinary equipment.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Friday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Veterinary equipment.
9.15 to 11.30 a. m.-----	Anatomy.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Saturday:

6 to 6.20 a. m.-----	Physical exercises.
8.20 a. m.-----	Inspection.
Half holiday.	

SIXTH WEEK

Monday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Anatomy.
9.15 to 11.30 a. m.-----	Parasites.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Tuesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Anatomy.
9.15 to 11.30 a. m.-----	Parasites.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Physiology.

Wednesday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Anatomy.
9.15 to 11.30 a. m.-----	Parasites.
Half holiday.	

Thursday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Anatomy.
9.15 to 11.30 a. m.-----	Parasites.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Practice walk.

Friday:

6 to 6.20 a. m.-----	Physical exercises.
7.45 to 9.15 a. m.-----	Anatomy.
9.15 to 11.30 a. m.-----	Parasites.
1 to 2 p. m.-----	School of the trooper.
2 to 3 p. m.-----	Practice walk.

Saturday:

6 to 6.20 a. m.-----	Physical exercises.
8.20 a. m.-----	Inspection.
Half holiday.	

Under date of January 30, 1918, the following outline of instruction was sent division veterinarians and veterinarians of auxiliary remount depots:¹⁶

SCHEDULE OF INSTRUCTIONS FOR OFFICERS OF VETERINARY CORPS ATTACHED TO DIVISIONS
OR AUXILIARY REMOUNT DEPOTS

The course will extend over a period of at least 10 weeks, and should cover the following subjects:

ARMY REGULATIONS

Recitations and practical work in Army Regulations, including muster rolls, pay rolls, correspondence as covered by Army Regulations and General Orders (10 hours).

Customs of the service (2 hours).

Manual of Courts-Martial—recitations and lectures (4 hours).

Veterinary Service regulations—recitations (4 hours).

Organization of veterinary units (4 hours).

Veterinary hygiene and stable management, feeds and feeding, food values, water supply and water, ventilation, building sites for stables and picket lines, routine stable management (20 hours).

Control of communicable diseases (5 hours).

Practical work in proper fitting of equipment of cavalry, artillery, draft and pack animals (10 hours).

Equitation (20 hours).

Drill, setting-up exercises, foot movement, saluting, marching (until proficient).

Training in the use of arms (until proficient).

The instruction will be practical, and paper work will be accomplished in studying subjects requiring same.

Recitations will be the rule in assembled class. Studying will be done outside the class periods.

Six hours weekly will be devoted to recitations and practical work.

Five hours weekly will be devoted to equitation, drill, and training in the use of arms.

By direction of the Surgeon General:

_____,
Lieutenant Colonel, Medical Corps, U. S. Army,
Acting Director, Veterinary Service.

Under date of May 9, 1918, the following letter relative to schools and instruction was sent division veterinarians by the Surgeon General:¹⁷

1. Pursuant to the issue of schedules of instruction for officers and enlisted men of the Veterinary Corps, attached to divisions and auxiliary remount depots, dated January 30, 1918, training schools were organized in each camp and remount depot.

2. Some of these schools developed satisfactory courses, detailed reports of which have been submitted to the Surgeon General. From others no reports have been received except through general veterinary inspectors.

3. As the schedules of instruction referred to in paragraph 1 (this letter) were general in character, obviously great variations in the kind of training given resulted.

4. An attempt is being made to standardize these courses of instruction in order that the training imparted will be uniform throughout the service.

5. It is therefore requested that you forward to the Office of the Surgeon General, veterinary division, a detailed report of the activities of the school or course of instruction under your command since its formation, if you have not already done so.

6. Relevant suggestions and constructive criticism are desired.

Up to August, 1918, no data had been received pertaining to instruction of veterinary personnel in 20 divisions. In 2 divisions the instruction given was of an irregular nature, while in 18 divisions the instruction given was thorough, inclusive, and conducted according to approved schedules.

During August and September, 1918, an outline for systematic courses of instruction, as given below, was issued by the Surgeon General to the division veterinarians of 12 divisions (9th to 20th, inclusive) for the training of veterinary officer and enlisted personnel. These courses were conducted to completion in 10 divisions and, due to demobilization and other causes, only partially completed in 2. Later reports show that no instruction was conducted in the 95th and 96th Divisions and that a partially completed course of instruction was accomplished in the 97th Division.¹⁷

WAR DEPARTMENT,
OFFICE OF THE SURGEON GENERAL,
Washington, August 26, 1918.

From: The Surgeon General.

To: Division veterinarians, 9th to 20th Divisions.

Subject: Instruction.

1. It is the desire of this office to establish a uniform course of instructions for the veterinary officers and men in all camps where a division is stationed, and, in order that this may be accomplished, the inclosed schedule of instructions is issued for your guidance and strict compliance.

2. The work pertaining to the treatment of sick animals and necessary sanitation is to be considered paramount and will not be neglected for the course of instruction. It is expected, however, that the necessary veterinary work will be thoroughly done and this instruction carried out at the same time.

3. It is incumbent upon every camp veterinarian to see that the veterinary officers and enlisted men of the division and camp attain a high degree of efficiency, and this can be accomplished by utilizing the formative period of the division in this country for intensive training. It is expected, however, that the course shall be continued in both camp and division after the division leaves. It is contemplated that every officer and man shall become proficient in the subjects outlined, and failure to do so should become the basis of official action. Recommendations for the promotion or elimination of officers and promotion and rejection of enlisted men should be based on progress shown in the course.

4. The instruction should be commenced as soon after the receipt of this letter as practicable. The course is so arranged that officers and enlisted men can start training at almost any time, and the subjects they have missed can be taken up at the end of the course.

5. *Instruction.*—(a) The camp veterinarian, who is also the division veterinarian, should personally supervise all instruction. The enlisted men should be given instruction as one class and not by individual units. The training of units as such in the necessary performance of their duties will not be neglected.

(b) This instruction will include the veterinary personnel attached to the depot brigades, camp headquarters, and any detached organizations which may be in the camp. The men assigned to the camp meat inspector will be required to take at least the school of the soldier and foot drill. For the enlisted personnel this course of instruction should be commenced when 40 per cent of the men are present.

(c) Whenever lectures are given or it is necessary to utilize a textbook for class reading, a quiz should always follow each lesson. Recitations will be held as outlined in schedule of instructions. It is believed the best results will be secured by invariably requiring men to recite what they have studied. The camp veterinarian will take steps to see that his officers are provided with the necessary textbooks.

(d) Efforts should be made to have the instruction continuous, and it is expected that the schedule will be followed as published. It will be changed only for good and sufficient reasons, and when this is done a full explanation will be submitted.

(e) The schedule is arranged according to weeks, but when exigencies of the service prevent the completion of any week's work it will be continued the following week and completed before taking up a new subject.

(f) Officers who have satisfactorily completed the training-school course and are found to be fully competent should be utilized as instructors for the enlisted men's classes. Officers' and enlisted men's classes can then be held simultaneously.

(g) A report will be submitted every Sunday direct to this office, covering the preceding week, giving the officers and enlisted men present, instruction accomplished, hours used for both officers' and enlisted men's classes. Officers and noncommissioned officers will be marked for each day's work, including examinations, on a scale of 10. An average mark of 7 will be considered as qualifying in a subject.

6. *Daily conference.*—The camp veterinarian will institute a daily conference, which all the veterinary officers in the camp and the divisional units will be required to attend. Questions pertaining to veterinary matters, unusual medical and surgical cases of importance,

sanitation in connection with stables, grooming, feeding, forage, etc., veterinary personal equipment, discipline, and regulations are matters to be considered. These conferences aim at closer cooperation in the veterinary service and should tend to increase its efficiency as one large unit instead of separate organizations. It is contemplated that these conferences will continue indefinitely.

7. The receipt of this letter to be acknowledged.

By direction of the Surgeon General:

C. F. MORSE,
Lieutenant Colonel, Medical Corps,
Director Veterinary Corps.

Schedule of instruction for veterinary officers

Hours	Subject	Daily lesson
FIRST WEEK		
5	Routine duties of the veterinary officers.----- 1. Handling enlisted men, relation between status of officers and men, etc.----- 2. Daily inspections for unit veterinarians (covering sanitary conditions of stables and corrals, forage, feeding and watering, mangers and watering troughs, grooming, exercise, inspection of shoeing, condition of feet, fitting of equipment). 3. Admission to sick report, method of recording diagnosis, etc. (Form 115), transfers, return to duty. 4. Detection of communicable diseases, procedure, disposition of the case, quarantine reports. 5. Extent of treating animals with medicines and supplies authorized for field units. 6. Evacuation of animals by mobile veterinary section. 7. Frequent consultation with troop, battery, and company commanders to establish harmonious relations regarding veterinary matters. See Circular Letter 27, veterinary division, Surgeon General's Office. This is suggestive of subjects to be covered. Additional subjects may be introduced at the discretion of the instructor.	$\frac{1}{2}$ hour lecture. $\frac{1}{2}$ hour. Practical work. (Visiting picket lines; inspecting animals well and sick; observing and reporting sanitary defects in corrals and stables.)
7 $\frac{1}{2}$	School of the soldier; foot drill.----- Textbook----- Drill Regulations and Service Manual for Sanitary Troops, United States Army, 1917 edition.	Pp. 9 to 17, par. 39. Pars. 40 to 54, inclusive. $\frac{1}{2}$ hour recitation; 1 hour drill.
SECOND WEEK		
6	Special Regulations No. 70, War Department (Army veterinary service)-----	1. Pars. 1 to 22. 2. Pars. 23 to 41. 3. Pars. 42 to 69. 4. Pars. 71 to 87. 5. Pars. 88 to 112. 6. Review.
7 $\frac{1}{2}$	School of the soldier; foot drill (continued)-----	Pp. 87 to 127; pars. 338 to 394, 404 to 407.
THIRD WEEK		
6	Special Regulations No. 70 (concluded)----- Circular letters, veterinary division, Surgeon General's Office, 1 to 27. Amendments Special Regulations No. 70.	1. Pars. 113 to 130. 2. Pars. 140 to 155. 3. C. R. 1 to 11. 4. C. R. 12 to 18. 5. C. R. 19 to 26. 6. Review.
7 $\frac{1}{2}$	School of the soldier; foot drill-----	1 $\frac{1}{2}$ hours daily.
FOURTH WEEK		
6	Army Regulations (with changes to No. 73)----- Blank forms referred to: Service record, par. 104; furlough, par. 106; descriptive list, deserter, par. 118; final statement, par. 140; certificate of disability, par. 159; death and disposal of remains, par. 162 $\frac{1}{2}$; noncommissioned officer's warrant, par. 274; sick report, par. 280; morning report, par. 280; descriptive list, card, public animals, par. 280; council book, pars. 327 to 280; delinquency record, par. 280; service record, par. 280; daily roster, par. 355.	1. Pars. 1 to 92. 2. Pars. 104 to 177. 3. Pars. 245 to 302, 316 to 330. 4. Pars. 355 to 416. 5. Pars. 416 to 440, 464 to 470, 491, 582 to 630. 6. Review.
10	Equitation-----	2 hours daily preliminary instruction (pars. 55 to 86, Drill Regulations for Sanitary Troops, United States Army, 1917).
FIFTH WEEK		
6	Army Regulations----- Blank forms referred to: Report of survey, 711; 1. and I. reports, 903; forage requisitions, 1077.	1. Pars. 657 to 703, 710 to 725, 732 to 739. 2. Pars. 774 to 790, 791 to 803, 807 to 833. 3. Pars. 878 to 914, 915 to 1000. 4. Pars. 1024 to 1073, 1077 to 1085, 1086 to 1099. 5. Pars. 1160 to 1145. 6. Review.
10	Equitation (continued)-----	2 hours daily.

Schedule of instruction for veterinary officers—Continued

Hours	Subject	Daily lesson
SIXTH WEEK		
6	Army Regulations..... Ration returns, 1209; pay rolls; allotment blanks; deposit books.	1. Pars. 1146 to 1183. 2. Pars. 1184 to 1193, 1195 to 1199, 1200 to 1238. 3. Pars. 1239 to 1254, 1256 to 1298. 4. Pars. 1299 to 1340, 1347 to 1360. 5. Pars. 1361 to 1383, 1386 to 1387, 1408 to 1420, 1447 to 1463. 6. Review.
10	Equitation.....	2 hours daily.
SEVENTH WEEK		
4	Army Regulations..... Property returns.	1. Pars. 1071 to 1076, 1486, 1513, 1537. 2. General review. 3. 2 hours examination.
3	Organization of veterinary units..... Tables of Organization No. 43: 1 veterinary field unit, 1 mobile veterinary section, 1 division veterinarian. Tables of Organization No. 109: Corps mobile veterinary hospital. Tables of Organization No. 330: Base veterinary hospital. Tables of Organization No. 331: Veterinary hospital. Veterinary equipment for units: References—Circular Letter No. 26, veterinary division, Surgeon General's Office; changes in pars. 902, 996, 967, 968, 970, 974 of Manual of the Medical Department and additional paragraphs 978 to 992, inclusive.	3 recitations.
3	Manual of Military Courts-Martial..... Articles of War: Formation of summary, special, and general courts; procedure for preferring charges, etc.	3 lectures and recitations.
2	Tent pitching..... Shelter tents, pars. 424 to 429; pyramidal tents, pars. 432 to 442; Drill Regulations and Service Manual for Sanitary Troops, United States Army, 1917 edition.	Practical work.
EIGHTH WEEK		
4	Army paper work..... Working knowledge of reports required by Circular No. 17, veterinary division Surgeon General's Office. Form 47 A. M. D. Sundry requisitions and papers. Certificate—Death of public animals, Army Regulations 1073; service records. Requisition for forage, Form 218, Q. M. C. Requisition for tableware and kitchen utensils, Form 166, Q. M. C. Certificate of breakage, Form 207, Q. M. C.; return of ordnance; return of horse equipment. Return of medical property, Form 17, A. B. C., M. D.; ration return, Form 223, Q. M. C.; survey reports; morning reports; sick reports. Veterinary medicines and supplies, Form 35, M. D. Requisition for clothing (bulk), Form 213, Q. M. C. Requisition for clothing (individual) Form 165, Q. M. C.	Demonstrations and recitations.
2	Customs of the service..... Officer's Manual (Moss) recommended for reference.	1 lecture; 1 recitation.
10	Manual of small arms pertaining to automatic pistol caliber .45..... Textbooks: Manual of the Automatic Pistol, caliber .45, model 1911, War Department, Document No. 801, The Adjutant General's Office (can be obtained by letter direct to The Adjutant General's Office). Small Arms Firing Manual, 1913, corrected to Mar. 15, 1918, pars. 167 to 175, inclusive. Attempt should be made to borrow enough pistols for class demonstration and target practice, if they are not furnished. It is very important that every officer and man become thoroughly familiar with this pistol, its parts, etc.	Demonstration and knowledge of parts of pistol; practical work; target practice.
NINTH WEEK		
7½	Veterinary hygiene..... Food values (pars. 155 to 202, Sanitary Service Manual); water supply; disposal of manure; ventilation; building sites for stables and picket lines; use of baling wire, for fences, racks, etc.; stable management; quarantine, methods of disinfection; floors for stalls, picket lines, methods of proper repair; drainage, disposal of carcasses (cremation, cross trench; and other systems, burial, danger of; proper methods); care of feet; clothing. Text: Smith's Veterinary Hygiene should be borrowed from veterinary hospital, remount depot, and used as text to cover subject thoroughly. Control of communicable diseases..... Text: Epizootics and Their Control During War (Leibold). NOTE.—May be borrowed from remount veterinary hospital as noted above.	1½ hours daily; 5 periods. 1. Pt. 1. 2. Pp. 29 to 84. 3. Pp. 84 to 126. 4. Pp. 127 to 153. 5. Pp. 155 to 207. 6. Review.

Schedule of instruction for veterinary officers—Continued

Hours	Subject	Daily lesson
TENTH WEEK		
6	Field service regulations, 1914, corrected to Apr. 15, 1917.....	1. Pp. 9 to 11, 43 to 50, 51 to 72. 2. Pp. 114 to 122, 123, 124 to 129. 3. Pp. 130 to 132, 133 to 159. 4. Pp. 171 to 178, 179 to 180, 181 to 185. 5. Review.
5	Cavalry full-pack equipment..... Field Artillery—harness fitting; draft harness. Pack-animal equipment and fitting. Gas defense instruction: Arrangements should be made with proper officer of the division to have all officers and men take prescribed course in gas defense. Instruction in first aid should be arranged with the surgeon.	Practical work and demonstrations.

Schedule of instruction for enlisted men, Veterinary Corps

Hours	Subject	Daily lesson
FIRST WEEK		
6	Stable management..... Textbook: Manual for Stable Sergeants, War Department Document 611, The Adjutant General's Office.	1. Pars. 119 to 130. 2. Pars. 131 to 155. 3. Pars. 156 to 202. 4. Pars. 203 to 227½. 5. Pars. 228 to 244. 6. Review.
1½	Military courtesies.....	1½ hours.
6	Army Regulations, pars. 375 to 392½. To be read and carefully explained. School of the soldier and detachment (detachment formation for inspection); foot drill. Textbook: Drill Regulations and Service Manual for Sanitary Troops, United States Army, 1917; (1) pt. 1 to par. 55, (2) pars. 87 to 127, inclusive, (3) pars. 388 to 394.	1½ hours daily for 4 days.
SECOND WEEK		
6	Stable management.....	1. Pars. 244 to 257. 2. Pars. 258 to 282. 3. Pars. 283 to 345. 4. Pars. 346 to 362. 5. Pars. 363 to 373. 6. Review.
7½	School of the soldier and detachment; foot drill (continued).....	1½ hours daily.
THIRD WEEK		
6	Communicable diseases..... (1) Glanders, (2) influenza, (3) mange, (4) lice, (5) isolation—quarantine; disinfection (pars. 464 to 487, Sanitary Service Manual). NOTE.—The enlisted personnel should have at least an elementary knowledge of these diseases and conditions in order that they may be able to recognize them when the necessity arises.	To be by lectures, recitations, and inspection, of cases when possible.
7½	School of the soldier and detachment; foot drill.....	1½ hours daily.
FOURTH WEEK		
2	Cavalry pull-pack equipment..... See memorandum attached; also appendix. Drill Regulations and Service Manual for Sanitary Troops, 1917.	2 lessons, 1 hour each, putting together and taking apart equipment per memorandum attached.
4	Pack-saddle equipment..... See Manual of the Medical Department, par. 953, for directions. For entire enlisted personnel.	2 lessons, 2 hours each.
7½	School of the soldier detachment; foot drill.....	1½ hours daily.
3	Army paper work, for noncommissioned officers, farriers, and selected privates..... These men should be given instruction in the paper work necessary for the various veterinary units of a division. 1. Official correspondence and indorsements. See Army Regulations, pars. 775, 776, 777, 782, 783. 2. Service records. See directions on pp. 1 and 2 and explain. 3. Promotions and demotions for enlisted grades in the Veterinary Corps; also Army Regulations, pars. 270, 272, 274, 275, 276, 277, 278. See circular letter, veterinary division No. 13, revised Aug. 14, 1918; General Order 58, par. 10, War Department, June 22, 1918. 4. Working knowledge of ration returns. See directions on cover of ration return book.	1 hour, three times a week.

Schedule of instruction for enlisted men, Veterinary Corps—Continued

Hours	Subject	Daily lesson
FIFTH WEEK		
10	Equitation..... Textbook: Preliminary instruction, Drill Regulations and Service Manual for Sanitary Troops, 1917, pars. 55 to 86. NOTE.—If there are not sufficient horses for equitation for the entire personnel, facilities will be utilized so far as possible with view to training the largest number of men. Time assigned to equitation to be used for foot drill when equitation is impossible from lack of animals or equipment.	2 hours.
2	Foot drill.....	1 hour twice a week.
3	Army paper work (continued)..... 5. Sick report. See directions in sick report book. Army Regulations, pars. 1471-1472. 6. Memorandum receipts. Army Regulations, par. 281; Manual for the Quartermaster Corps, United States Army, vol. 1, 1916, pars. 2073 to 2091, inclusive. 7. Property—medical, quartermaster, ordnance (defined, Army Regulations, par. 1512). (a) Accountability and responsibility, Army Regulations, pars. 657 to 701, inclusive. (b) Unserviceable, Army Regulations, par. 678 (changed by Changes, Army Regulations No. 56, War Department, 1917)—medical, Army Regulations, par. 1488; ordnance, Army Regulations, par. 1534; accountability, Army Regulations, par. 1535; quartermaster, Army Regulations, par. 678 (changed by Changes, Army Regulations, No. 56, War Department, 1917). (c) Expendable and nonexpendable—medical, p. 245, Manual of the Medical Department; quartermaster, Manual of the Quartermaster Corps, United States Army, vol. 1, 1916, par. 2207; ordnance, see ordnance price list; lost and destroyed, Army Regulations, pars. 682 to 692, inclusive. (d) Equipment—(1) veterinary units, new paragraphs of Manual of the Medical Department, 985 and 988; (2) mobile veterinary section, new paragraphs of Manual of the Medical Department, 989 and 990.	1 hour three times a week.
SIXTH WEEK		
6	Tent pitching..... (1) Shelter tents and full field equipment. (2) Pyramidal tents. (3) Hospital wall tents. Textbook, pars. 424 to 434, Drill Regulations and Sanitary Manual for Sanitary Troops 1917.	1 to 2 hours daily for allotted time.
10	Equitation.....	2 hours daily.
2	Foot drill.....	1 hour twice a week.
3	Army paper work (continued)..... 8. Morning reports, daily changes, etc. See Special Regulations, War Department, No. 57 A, 1918. 9. Descriptive lists public animals. Also see changes, Army Regulations, pars. 1067, 1069, 1070. Inspection and inventory reports, public animals. Destruction, public animals, Army Regulations, par. 1073; Changes, Army Regulations, No. 58, 1917.	1 hour three times a week.
SEVENTH WEEK		
5	Manual of small arms..... Textbooks: Manual of the Automatic Pistol, Caliber .45, model 1911, War Department, Document No. 801 (can be obtained by letter from The Adjutant General's Office). Small Arms Firing Manual, 1917, corrected to Mar. 15, 1918, pars. 167 to 175, inclusive. Authority for ammunition for target practice and quote following indorsement under remarks on ordnance requisition: "471.4 pistol ball ammunition (Misc. Div.), War Department, The Adjutant General's Office, Apr. 4, 1918. To the Surgeon General, returned. Being armed as stated in General Order No. 8, War Department, 1918, it would seem that the allowance set forth in subparagraph C, par. 3, Special Regulations, 31, War Department 1917, applies. By order of the Secretary of War; J. B. Wilson, Adjutant General."	1 to 2 hours daily for allotted time.
10	Equitation.....	2 hours daily.
2	Foot drill.....	1 hour twice a week.
3	Army paper work (continued)..... 11. Forage and requisitions for same, Army Regulations, pars. 1077 to 1085. 12. Mess and mess management, Army Regulations, pars. 296 to 302. See Manual for Army Cooks.	1 hour three times a week.
EIGHTH WEEK		
15	Manual of small arms (continued).....	To completion.
1	Foot drill.....	1 hour a week.
1	Equitation.....	Do.

Schedule of instruction for enlisted men, Veterinary Corps—Continued

Hours	Subject	Daily lesson
NINTH WEEK		
6	Practical work for entire enlisted personnel. 1. Making and applying foot sac bandages. 2. Foot bandaging with regulation bandages. 3. Applying bandages to different parts of the body, legs, throat, chest; making and applying many-tailed bandages to knee and hock. 4. Practical demonstration of means of restraint, knee strap, rope; sidelines; how made and applied; throwing horse with hobbles, side lines—rope harness; preparation of and care of horse thrown. 5. Tying of knots; making rope harness, splicing of rope, care of same; making twitches. 6. Improvising slings; use of same; care of horses when in slings. 7. Improvising open air-operating areas for casting horses. 8. Preparations of animals for operations; cleaning parts, clipping operating areas, disinfection of parts, care of horses for operations where anesthesia is used.	2 hours at stables. Do.
1	Foot drill.	1 hour a week.
1	Equitation.	Do.
TENTH WEEK		
8	Practical work. 10. Handling and care of instruments. To include all articles supplied with the veterinary field-unit chest. 11. Methods used to disinfect or sterilize instruments, hands, etc., with facilities available. 12. Routine medical work. (1) Temperature; use of thermometer. (2) Respiration, number per minute, significance, quality; how observed. (3) Pulse; normal; how taken. 13. Administration of medicine. (a) By bolus. (b) Syringe; care of, precautions necessary; methods of controlling animal. (c) Hypodermic syringe; its study, to include care, how used, how to sterilize; capacity. (d) Disinfection of stables; corrals; field disinfectants. 14. Care to be taken in shipping horses by rail; preparation of cars, feeding; preparation of horses. 15. Use of baling wire for fences, hay racks, halter shanks, etc.; practical work making same. 16. Care of feet and shoeing. (1) Lecture covering condition of feet, care to be taken with same; dangers of excessive moisture, excessive dryness; proper shoeing injuries to feet and conditions following. (2) Practical demonstration at stables, 1 to 2 hours, examining feet, pointing out things taken up at lecture.	2 hours. Do. Do.
1	Foot drill.	1 hour.
1	Equitation.	1 to 2 hours.
		1 hour a week.
		Do.

HORSESHOER

A suitable man should be selected for horseshoer and arrangements made to have him attend the horseshoeing school at the remount depot.

GAS DEFENSE

Arrangements should be made to have all officers and men thoroughly instructed in this line.

FIRST AID AND PERSONAL HYGIENE

Arrangements should be made with the surgeon for necessary instructions in above subjects.

SETTING-UP EXERCISES

Daily, as prescribed by division or camp orders. If not provided for in such orders, the camp veterinarian will prescribe exercises to be taken, and every officer and man in divisional veterinary personnel will be required to take same as daily routine.

After this course of instruction is completed, it should be arranged, if practicable, to give the men of the divisional veterinary detachment at least 1 hour of foot drill and 1 hour of equitation a week.

By direction of the Surgeon General:

C. F. MORSE,
Lieutenant Colonel, Medical Corps,
Director Veterinary Corps.

A separate schedule which was used in connection with this instruction follows:¹⁶

MEMORANDUM—CAVALRY FULL PACK EQUIPMENT

Full pack consists of saddle, saddlebags, one United States feed bag, and roll. The roll consists of—

- 1 shelter half.
- 1 shelter half pole—on right of roll.
- 5 shelter half pins—on left of roll.
- 1 blanket—United States.
- 1 towel.
- 1 comb.
- 1 brush, tooth.
- 1 brush, hair.
- 1 cake of soap, toilet.
- 1 undershirt.
- 1 underdrawers.
- 1 pair of socks.

The above toilet articles laid evenly at upper end of roll so it will roll evenly and straight. Roll should not exceed 44 inches in length when rolled.

Feed bag: Inner white sack contains three feeds of grain for horse. When strapped to top of roll, the mark "U. S." should be on the right saddlebags.

Contents of right saddlebag:

- 2 horseshoes, front and hind.
- 16 horseshoe nails.
- 1 brush.
- 1 curry comb.
- Extra toilet articles.

Left saddlebag:

- Soldier's rations.
- Soldier's mess kit.

Strapped to side of left saddlebag:

- Picket pin; picket line, restrapped to cantle.
- Canteen strapped to right side of cantle.

IN POSTS

In May, 1917, department surgeons were provided by the Surgeon General with an outline similar to the one intended for divisional personnel quoted above, for a systematized course of instruction, which was to be carried out by medical officers at the military posts and relatively small stations under their jurisdiction.¹⁸ Department surgeons were made responsible for the effective carrying out of this course of instruction to the extent practicable under local conditions. From the outline sent to the department surgeons detailed courses of instruction were prepared and sent out to surgeons of stations and posts to be used as a basis for the training of sanitary personnel.

The extent to which this instruction was carried out varied with the local practicability for training and with the individual energy, initiation, and ingenuity of commanding officers, surgeons, and the instructors themselves. In many small stations it was necessarily largely a matter of personal reading, but in some of the larger posts many officers and men were given valuable and effective training.

The pressing need for officers for overseas service necessitated the rapid drawing away from posts of the younger, physically fit and alert, medical officers and their replacement by older men, generally over 50 years of age.

These older officers were just as patriotic and earnest as the younger officers, but as a class were not as adaptable to the needs of the service as were the men from 30 to 45 years of age. All officers assigned to posts in the early months of the war were generally not supplied with the service manuals and Army Regulations and in many instances there was delay in securing these books for them, thus preventing an early grasping by these officers of the details connected with Medical Department procedure in the Military Establishment. Many of the officers coming from small rural districts were also deplorably deficient in the scientific practice of their profession.¹⁹ These new medical men, derived from civil practice, however, found their places as best they could under Army conditions strange to them, and in the majority of instances soon came to appreciate the advantages to be derived from a practical course of schooling, which was instituted in practically all posts in accordance with the instructions quoted above.²⁰

In connection with the training of enlisted men in the posts, several important problems were to be met. The necessity for department surgeons to supply many hundreds of enlisted men in all grades to units forming inside their departments and elsewhere necessitated the establishment at some of the more important posts of large training detachments for the intensive training of these men.

In the Eastern Department, while training progressed in all the posts, the larger schools were established at first at Fort Myer, Va., Forts Hamilton and Jay, N. Y., where experienced medical officers directed the training and later at Fortress Monroe, Va., and Madison Barracks, N. Y.¹⁹

Large groups of partially trained recruits were being called for continually by department surgeons to be sent to hospitals forming within the departments. Later in the war the men furnished overseas units were replaced by limited-service men, who were distributed and absorbed by the different post hospitals throughout the departments. Every effort was made to bring these men up to a point of efficiency, but they proved generally unsatisfactory for Medical Department work.¹⁹

Before the establishment of the noncommissioned officers' schools at the larger stations the number of efficient noncommissioned officers became depleted, but the schools gradually decreased and corrected this shortage until, in at least the Eastern Department, there was a slight surplus of noncommissioned officers toward the close of the war.¹⁹

The constant changing of personnel, due to the demands of the service, made it impossible for many of the officers who commenced the courses to carry them to completion, but the reports received from stations show that conscientious effort was made in practically all stations and resulted in all cases in much improvement.¹⁹

In May, 1917, a camp intended primarily for the instruction of enlisted men was developed with about 50 medical officers and 2,000 enlisted men of the Medical Department at Fort Ethan Allen, Vt.²¹ This camp was variously designated as "18th Recruit Company," "Medical Department Training Company A," "Medical Department Training Units," "Medical Department Training Camp."

These recruits, drawn largely from the Medical Department recruiting stations attached to the department surgeon's office in Boston, and were medical

enlisted Reserve Corps men. They were organized into training companies by local orders. Though eight hours a day were devoted to drills and other instruction, the training was greatly handicapped by a shortage in trained instructors. Partially to overcome this, the most likely men were selected and given special training and made noncommissioned officers and used as instructors.

The training unit was abandoned the latter part of November, 1917, after the transfer of 129 men to Base Hospital No. 66, Tenafly, N. J. As the number remaining in the unit was too small to continue training to advantage, the remaining men were transferred to the permanent detachment of the Medical Department of the post hospital and the surplus noncommissioned officers were transferred elsewhere for duty.²¹

At Fort Strong a building was rented from the Long Island Hospital, at the nominal sum of \$1 per month, for the intensive instruction of selected Medical Department personnel of the coast defenses of Boston. Excellent results were reported by the department surgeon.²¹

The department surgeon, Central Department, stated in his annual report to the Surgeon General for the calendar year 1917, that practical school courses were instituted in accordance with a circular letter from the Surgeon General's Office, dated May 14, 1917, and was carried through in every detail with great credit to all concerned.²² He stated further:

Considering the frequent changes in both the commissioned and enlisted medical personnel and the fact that this personnel was largely composed of men new to the service, and the vast amount of work thrust upon them, their services were most gratifying to those charged with their training.

As no training school for Medical Reserve Corps officers was located on the Pacific coast, it became necessary immediately after the outbreak of the war for the department surgeon to prescribe a course of instruction, particularly in medical military subjects, in order that newly appointed officers might fit themselves for their new duties.

On account of the frequent changes in personnel it was not possible for any appreciable number of officers to complete any prescribed course, nevertheless, considerable progress and benefit was made in this connection. During the calendar year 1917, 2,059 enlisted men of the Medical Department were transferred to stations, camps, or regiments outside of the department on telegraphic orders from the War Department.²³

The department surgeon in reality ran a correspondence course for Medical Reserve and National Guard medical officers, as it was necessary to return several times in each case, for correction or completion, at least 75 per cent of the reports and returns received in the department surgeon's office. This was particularly true in regard to the sick and wounded reports and accounts for service or purchases from civilians.

The instruction in this department of so great a number of untrained enlisted personnel was greatly handicapped as was the case in all other departments, by the relatively small number of experienced officers and noncommissioned officers available as instructors. Nevertheless, by persistent effort prescribed courses of instruction were carried out as completely as was practicable, and as soon as they became qualified privates were promoted to noncommissioned grades.

REFERENCES

- (1) First indorsement, A. G. O., to Quartermaster General, May 11, 1917. Subject: Medical training camps. On file, Mail and Record Division, A. G. O., 2,581,692 (Old Files).
- (2) Letter from the Surgeon General, U. S. Army, to division surgeons of all organized divisions, Southern Department, May 14, 1917. Subject: Directions as to status and scope of instruction to be given all sanitary personnel. On file, Record Room, S. G. O., 174,912-E (Old Files).
- (3) Annual report of the Surgeon General, U. S. Army, 1918, 407.
- (4) Letter from the Surgeon General to all division surgeons, October 3, 1917. Subject: Training of sanitary personnel of divisions. Copy on file, Historical Division, S. G. O.
- (5) Letter from the Surgeon General to all division and camp surgeons and commanding officers of hospitals, June 13, 1918. Subject: Instruction of new medical officers. On file, Record Room, S. G. O., 353 (M. O. T. C.) C.
- (6) Circular letter, Surgeon General's office, November 1, 1917. Subject: Training of sanitary personnel of divisions.
- (7) Letter from the Surgeon General of the Army to division surgeons, May 21, 1918. Subject: Organization of camp surgeon's office. On file, Historical Division, S. G. O.
- (8) Memorandum from the Surgeon General of the Army to camp surgeons, May 27, 1918. Subject: Scheme for organization of Medical Department activities. On file, Historical Division, S. G. O.
- (9) Schedule of training for officers of the Medical Department, Camp Funston, Kans. Copy on file, Historical Division, S. G. O.
- (10) Memorandum for The Adjutant General of the Army, October 3, 1917. Subject: Personnel and material for instructions in gas defense, by Tasker H. Bliss, major general, C. of S. On file, A. G. O., 220.63.
- (11) S. O. No. 48, W. D., February 27, 1918. .
- (12) Memorandum from The Adjutant General of the Army, April —, 1918, signed J. J. B. From the office of the Chief of Staff. On file, Chemical War Service.
- (13) Outline of instruction for the enlisted personnel of the Medical Department, 89th Division. On file, Record Room, S. G. O., 353 (89th Division) G.
- (14) Schedule of instruction for enlisted men of the Medical Department, 89th Division. On file, Record Room, S. G. O., 353 (89th Division) G.
- (15) Special report to the Surgeon General. Subject: Training of the personnel of the Dental Corps during the World War. On file, Historical Division, S. G. O.
- (16) Special Regulations No. 7, W. D., December 15, 1917.
- (17) History of Veterinary Divisional Training (compiled from records and reports). On file, Veterinary Department, S. G. O.
- (18) Letter from the Surgeon General of the Army to all department surgeons, May 14, 1917. Subject: Directions as to nature and scope of instruction to be given sanitary personnel at posts. On file, Record Room, S. G. O., 353 (General).
- (19) Annual report, department surgeon, Northeastern Department, for the year 1917, February 21, 1918, by Col. P. F. Straub, M. C., U. S. A. On file, Record Room, S. G. O., 319.1 (Northeastern Department) A A.
- (20) Annual report, department surgeon, Central Department, for the year 1917, February 14, 1918. On file, Record Room, S. G. O., 319.1 (Annual Report, Central Department) A A.
- (21) Correspondence on the subject of training, from the surgeon, Fort Ethan Allen, to the department surgeon, Eastern Department. On file, Record Room, S. G. O., 354.6 (Fort Ethan Allen, Vt.) N.
- (22) Annual report of the Surgeon General of the Army, 1918.
- (23) Report from Col. L. M. Maus, M. C., U. S. A. (relieved), department surgeon, Western Department, January 31, 1918, to the Surgeon General, U. S. Army, Washington, D. C. Subject: Annual report calendar year 1917. On file, Record Room, S. G. O., 319.1 (Annual Report 1917) A A.

CHAPTER V

TRAINING IN HOSPITALS

OFFICERS

GENERAL PROFESSIONAL TRAINING

The original assignments of medical officers to general and base hospitals were determined by the Surgeon General;¹ that is to say, efforts were made to assign a competent medical officer of the Regular Army to command each hospital with three or four experienced noncommissioned officers of the Medical Department for the training of the enlisted force and as a nucleus for an organization. Furthermore, in the original assignments of Medical Reserve officers to hospitals, those assigned in the various specialties were carefully selected from among officers known to be especially qualified.

The details of the training of this personnel in the early period of the war were left largely to the initiative of each commanding officer to carry out as best he could, and varied in extent with the availability and qualifications of instructors.² In all hospitals, even from the beginning, an effort at some military training was carried out, usually consisting of lectures on Army Regulations, Manual for the Medical Department, customs of the service, drill, guard duty, officer of the day duty, etc. Professional training and instruction was outlined and carried out in accordance with the instructions of the Surgeon General. It varied from the experience gained by the actual performance of duties, such as the assistance by junior officers to those already qualified, in the early period of the war, to very broad and complete courses of instruction which covered every phase of hospital work in the later period.

On account of the rapidly growing demand for Medical Department personnel for every variety of duty and the impracticability of training all so needed at the medical officers' training camps, it was necessary to order many officers and men direct from civil life to hospitals.³ This resulted in temporary overcrowding in some instances but was beneficial in that the staff was doubled and even tripled at times, thus making it possible to secure sufficient personnel, over and above that required for the routine duty in the hospital, to carry out schedules of instruction. It soon became apparent to the Surgeon General that a certain proportion of these officers were not being qualified for their duties as rapidly as was desired; therefore, in the fall of 1917 the following outline of instruction was forwarded to the commanding officers of base and general hospitals to be used as a basis for the training of officers:⁴

PROFESSIONAL TRAINING OF MEDICAL OFFICERS

ADMINISTRATION

Lectures by the commanding officer and such officers of the base hospital staff as have had previous experience and training in administrative subjects. These lectures to deal particularly with base hospital regulations and duties, with specific instruction in the duties of commanding officer, adjutant, registrar, mess officer, supply officer, commanding officer of detachments, and ward administration. Such courses of study and recitation will be prescribed in Army Regulations, Manual for the Medical Department, and other manuals as are necessary and practicable.

MEDICAL SUPPLY OFFICERS

1. The supply tables:
 - (a) Classification of supplies.
 - (b) Nomenclature of supplies.
 - (c) Normal allowance of various Medical Department units (pars. 474-476 and 842-959, Manual for the Medical Department, 1916).
2. Requisitions (pars. 474-495).
3. Transfer of medical supplies (pars. 496-500).
4. Accountability (pars. 501-503).
5. Distribution of field supplies in time of peace (pars. 504-506).
6. Distribution in zone of advance (see Field Service Regulations).
7. Replenishment in combat (pars. 551-554 and 858).
8. Returns of medical property (pars. 507-508).
9. Sales of medical property (pars. 509-510).
10. Distribution of medical property on abandonment of post (par. 511).
11. Use and care of medical property (pars. 512-526).
12. Base medical supply depots (pars. 782-786).
13. The advance medical supply depot (pars. 787-792).

INTERNAL MEDICINE (BY CHIEFS OF MEDICAL SERVICE)

This course of instruction is intended to familiarize medical officers serving with troops in the field with the more important diseases which they may encounter, their diagnosis, and the means of their prevention and treatment, with a view to securing prompt and suitable action when such cases arise. It is not the purpose of this instruction to make regimental officers hospital specialists, but to indicate to them their part in the teamwork of the Medical Department which will result in each sick soldier receiving promptly the best treatment, whether that be in the regimental field hospital, at the base hospital, or in general hospitals, and will make them most efficient in preventing the spread of disease among the troops.

I. Examination of recruits:

1. Methods of examination of the heart.
2. Principles of interpretation.
3. Causes for rejection.
4. Cardiovascular diseases which are most often overlooked in recruiting.
5. Border-line cases and difficult decisions.

II. Examination of the lungs.

III. Disorders of the heart common in soldiers:

1. The soldier's heart, symptoms, causes, prevention, treatment, including projected special hospitals, and prognosis, military, and individual. Emphasis on the importance of observations of recruits during training by regimental medical officers and overseas. The importance of a sufficient period for convalescence and retraining after acute infections; in particular, influenza, trench fever, and diarrhea.

IV. Tuberculosis in the soldier.

V. Lobar pneumonia. The newer knowledge of the fixed types of pneumococci, the means of determination of the type for specific treatment, treatment of Type I, infections by serum; symptoms and physical signs of pneumonia in the first few days and the importance of early diagnosis; prognosis in the different types.

VI. The acute respiratory infections, sore throats and diphtheria.

1. Importance of acute colds and bronchitis as forerunners of pneumonia; complications of acute respiratory infections, especially infection of the accessory sinuses and middle ear.
2. Tonsillitis, pharyngitis, etc. Importance of throat cultures in all cases; complications, especially acute nephritis, endocarditis, and other forms of streptococcus sepsis; importance of urine examination after tonsillitis before return to duty.

VI. The acute respiratory infections, sore throats and diphtheria—Continued.

3. Diphtheria, diagnosis, antitoxin treatment; carriers of the virulent and avirulent bacilli and modes of dealing with them. Carriers after an attack usually harbor bacilli in the tonsils and are even rendered free by tonsillectomy. The Shick reaction and its value in determining the need for immunization of a group of individuals.

VII. Epidemic meningitis and poliomyelitis:

1. Importance of epidemic meningitis among troops in camps and barracks.
2. Early symptoms and diagnosis.
3. Lumbar puncture and exact diagnosis.
4. Serum treatment, including strains of meningococci and bearing on failure of serum treatment as in the epidemic among Canadian and British troops early in the war.
5. Carriers and the great importance of their detection and isolation. Improved methods for the treatment of carriers.
6. A brief sketch of poliomyelitis with reference to the more acute forms and possibility of confusion with meningitis, either epidemic or tuberculous.

VIII. The exanthemata:

1. Measles; early diagnosis, especially Koplik spots; treatment and prevention with special reference to Colonel Munson's observations on sun and air.
2. German measles and its differential diagnosis from measles.
3. Scarlet fever; early diagnosis, prevention; the important complications in the throat, heart, kidneys, and joints; combined scarlet fever and diphtheria.
4. Typhus fever; modern knowledge of transmission by the louse; frequency in prison camps, etc.; symptoms and diagnosis of mild and severe forms; prevention.
5. Smallpox; recognition of mild cases of varioloid.

IX. The malarial fevers; mode of treatment and prevention:

1. Treatment of tertian malaria and of estivoautumnal with special reference to the need for continued use of quinine; treatment of pernicious malaria, intravenous and intramuscular use of quinine dihydrochloride.
2. The animal parasites, especially hookworm; treatment by oil of chenopodium; prevention.

X. Dysentery and diarrhea:

1. Bacillary dysentery; its causes, symptoms, treatment, and prevention.
2. Amebic dysentery; diagnosis and difference in symptoms from those of bacillary dysentery; treatment by emetine; importance of early treatment of acute stage; general treatment; amebic cysts and carriers.
3. The nonspecific diarrheas; causes, prevention, importance of treatment and safeguarding for a few days subsequently.

XI. Typhoid and paratyphoid fevers and trench fever:

1. Typhoid and paratyphoid with reference to modes of infection and importance of general prophylaxis. Specific immunization; diagnosis in the immunized; carriers.
2. Trench fever; its symptoms, diagnosis, wholly favorable prognosis, need for rest and for safeguarding during convalescence; theories as to causation and transmission.

XII. Nephritis, infectious jaundice, and tetanus:

1. Acute nephritis as seen at the Western Front.
2. Infectious jaundice and spirochetal infections.
3. Tetanus; its prevention; symptoms of mild tetanus; treatment by intraspinal antitoxin.

XIII. Gas poisoning; its symptoms, diagnosis, prognosis, and treatment.

SYLLABUS OF INSTRUCTION IN STANDARD METHODS FOR TREATING FRACTURES

The purpose of this course of instruction is to familiarize medical officers with standard methods in the treatment of fractures. It is intended that officers so trained will not only serve in the special fracture hospital, but in field, base, and general hospitals, and as regimental officers as well, so that a continuity in the methods for treating fractures can be maintained. By this means, it is proposed to establish teamwork on the part of medical officers throughout the Army, in order that the wounded soldier will receive promptly the most efficient treatment whether at the regimental aid station, the dressing station, the field hospital, the evacuation hospital, or the base hospital, as well as along the lines of transportation. The logical result of this cooperation will be to secure early recovery, lessen deformity, and reduce the number of soldiers permanently disabled to a minimum. It is realized that the exigencies of the service in the zone of the advance will frequently be such as to render the standard methods impracticable, but by indicating clearly the desideratum it is hoped that the difficulties in the field will act not so much as an obstacle but as a stimulus to the ingenuity of the medical officers.

Fractures in war are usually compound and will be much more prevalent than the simple, so that any treatment which considers merely the fracture and not the wound and the soldier would be quite ineffective. Consequently, the course of instruction will be initiated with a brief but thorough presentation of wounds, from a military standpoint, their causes, and their treatment. This will be followed by the course in standard methods for treating fractures proper. The instruction will be intensely practical in nature, consisting in the demonstration of the splints, their adaptability and application, and in clinics

CAUSES AND VARIETIES OF WOUNDS

1. Bullet wounds:
 - (a) Shrapnel.
 - (b) Rifle.
 - (c) Pistol.
2. Shell wounds:
 - (a) Shell fragments.
 - (b) Shell fuse.
 - (c) Hand grenade.
3. Bayonet wound; sword wound.
4. Burns.
5. Gas.
6. Varieties of wounds:
 - (a) Abrasion.
 - (b) Contusion.
 - (c) Laceration.
 - (d) Puncture; complete or incomplete.

CONDITION OF WOUNDED MEN

1. Hemorrhage, excessive (shock).
2. Exposure; wet, cold. Hunger.
3. Shell shock.
4. Gas.
5. Visceral injury; abdominal, thoracic and head.
6. Infection; pyogenic, tetanus, gas bacillus.
7. Suppuration.

TREATMENT OF WOUNDS

General:

1. Water administered—
 - (a) Mouth.
 - (b) Rectum.
 - (c) Hypodermoclysis.
 - (d) Intravenous. Dangers.
2. Food and hot drinks.
3. Medication.

Local:

1. Wound antisepsis—
 - (a) Excision, necrotic tissue.
 - (b) Wound cleansing, foreign body removal.
 - (c) Tincture of iodine.
 - (d) Dakin-Carrel method.
 - (e) Dichloramine-T.
2. Hemorrhage—
 - (a) Pressure by bandage. Cautions.
 - (b) Packed. Cautions.
 - (c) Tourniquet. Cautions.
 - (d) Ligation of artery. Cautions.
 - (e) Amputation. Indications.
3. Dressings—
 - (a) Dry antiseptic.
 - (b) Suture. Indications.
 - (c) Drainage. Indications.
4. Infection—
 - (a) Suppuration.
 - (b) Gangrene.
 - (c) Drainage.

FRACTURES

At the dressing station:

1. General treatment.
2. Wound antisepsis; 2 per cent iodine superficial.
3. Wound cleansing.
4. Immobilization and extension methods.
 - I. Fractures of the upper extremity—
 - (a) Simplest splint arm to chest.
 - (b) Screen wire and wood splints.
 - (c) If practicable, Thomas arm splint; elbow splint.
 - II. Fractures of the lower extremity—
 - (a) Rifle down the side of leg with coat between legs and the legs lashed together.
 - (b) Screen wire and wooden splints.
 - (c) C. femur. Thomas knee splint for fracture of femur. In fracture of femur, the soldier once placed on litter is not to be removed therefrom.
 - III. Fracture of rib. Immobilization.
 - IV. Fracture of pelvis. Fixation. Not removed from litter.
 - V. Joints.
5. Infections. Special treatment—
 - (a) Tetanus serum.
 - (b) Gas bacillus-aeration. Antitoxin.
 - (c) Pyogenic.
6. Amputations, contraindications. Indications.
7. Anesthesia.
8. Diagnosis tags. These must be kept up to date, particularly with fractures.

TRANSPORTATION

1. Cases sorted into transportable and nontransportable.
2. Maintenance of immobilization and extension, where practicable. Methods. Not more than 12 hours should elapse without the splint being inspected by a surgeon and necessary adjustments made.
3. Femur, special treatment for fractures of, in transit. Not to be removed from litter. Thomas knee splint inspected once every 12 hours.

EVACUATION HOSPITAL, SPECIAL FRACTURE HOSPITAL, BASE HOSPITAL

1. Early and adequate surgery.
2. Wound antisepsis.
3. Wound cleansing.
4. Conservation of fragments.
5. Immobilization and extension. Standard methods.
 - I. Fracture of upper extremity—
 - (a) Humerus.
 1. Jones's humerus extension splint.
 2. Jones's abduction splint.
 - (b) Elbow splint.
 - (c) Radius and ulna. Jones's forearm and wrist splint.
 - II. Fracture of lower extremity—
 - (a) Femur. Thomas knee splint; Hodgen splint, overhead suspension and extension from Balkan frame or on special fracture bed.
 - (b) Tibia and fibula. Jones's leg splint and Cabot splint.
 - III. Fracture of rib. Immobilization.
 - IV. Fracture of pelvis. Fixation. Bradford frame.
 - V. Joints. Operative indications. Foreign body removal. Drain.
6. Malunion and nonunion, caution; late tetanus and infection.
7. Infections; special treatment.
8. Operative treatment, indications for. Standard methods.
9. Amputation. Special.
10. Anesthesia. Ether drop method, chloroform; nitrous oxide; spinal, tropococaine.
11. Examinations, special methods:
 - (a) Roentgen ray.
 - (b) Bacteriological.
12. Massage and baking.
13. Hydrotherapy.
14. Curative workshop; reconstruction.

THORACIC WOUNDS

- I. Causes and varieties of wounds:
 1. Bullet wounds—
 - (a) Shrapnel.
 - (b) Rifle.
 - (c) Pistol.
 2. Shell wounds—
 - (a) Shell fragments.
 - (b) Shell fuse.
 - (c) Hand grenade.
 3. Bayonet wound, sword wound.
 4. Varieties of wounds—
 - (a) Laceration. Thoracic wall. Back.
 - (b) Perforating (puncture) wounds—complete, incomplete.
 - (c) Concussion of spinal cord—brachial plexus.
 - (d) Pseudo-perforating wounds.
- II. Pathology:
 1. Shock.
 2. Hemorrhage.
 3. Dyspnea.
 4. Hemoptysis.
 5. Vomiting and hiccough.
 6. Death, immediate causes of.

II. Pathology—Continued.

7. Infection—

- (a) Pyogenic.
- (b) Tetanus.
- (c) Bacillus—aerogenes.

8. Surgical emphysema.

III. Clinical aspects:

- 1. Pneumothorax.
- 2. Hemothorax.
- 3. Pyothorax (empyema).
- 4. Fracture of ribs.
- 5. Pneumonia.
- 6. Pleurisy—effusion.
- 7. Abscess and gangrene of lung.
- 8. Subphrenic abscess.
- 9. Pericarditis. Pneumocardium.
- 10. Paralysis—monoplegia, paraplegia.
- 11. Sequelæ.

IV. Treatment:

- 1. Immediate firing line, regimental aid, or dressing station—
 - (a) General care. Water. Hot drinks. Blankets.
 - (b) Wound antisepsis.
 - (c) Hemorrhage.
 - (d) Wound cleansing, if practicable.
 - (e) Dressing. Dry gauze, graduated pressure.
 - (f) Posture of patient—recumbent on affected side. If practicable not disturbed. No walking.
 - (g) Medication. Morphine. Atropine.
 - (h) Transportation. Rest one of main factors in treatment.
- 2. Intermediate. Regimental aid. Dressing station—
 - (a) General care. Food. Water. Hot drinks. Blankets.
 - (b) Wound antisepsis.
 - (c) Anesthesia. Chloroform; ether; drop method.
 - (d) Wound cleansing. Operation. Indication for. Foreign body, removal.
 - (e) Dressings. Immobilization of affected side—
 - 1. Fresh cases.
 - 2. Suppurative cases—
 - Dichloramine-T.
 - Carrel-Dakin.
 - Moist dressing.
 - (f) Medication.
- 3. Field hospital, evacuation hospital, base hospital—
 - (a) Examination, special methods—
 - Bacteriological.
 - Roentgen ray.
 - (b) Operations. Special methods. Indications.
 - (c) Suppuration; treatment of.
 - (d) Complications; special treatment for.

ABDOMINAL WOUNDS

I. Variety of wounds:

- 1. Contusions—
 - (a) Abdominal wall.
 - (b) Ruptured viscera, or blood vessels.
- 2. Puncture wound of abdominal wall (nonpenetrating).
- 3. Penetrating wounds (nonperforative of viscera, or blood vessels).
- 4. Perforating wounds.

II. Pathology:

1. Shock.
2. Hemorrhage.
3. Infection—
 - (a) Pyogenic.
 - (b) Tetanus.
 - (c) *Bacillus aerogenes*.
4. Protrusion of viscera.
5. Perforation, visceral.
6. Peritonitis.
7. Extraperitoneal infection.

III. Diagnosis. Early differential.

IV. Clinical aspects:

1. Hemorrhage.
2. Perforation of hollow viscus, early symptoms.
3. Extravasation, urine.
4. Peritonitis.
5. Abscess; subphrenic, perirenal; pelvis.
6. Septicemia.

V. Treatment:

1. Immediate, firing line, regimental aid, or dressing station—
 - (a) General care. Blankets. No water. No food.
 - (b) Wound antisepsis. Iodine.
 - (c) Dressings. Dry gauze.
 - (d) Posture of patient. On back, thighs flexed, head raised.
 - (e) Medication. Morphine.
 - (f) Transportation. Patient moved to adequate operating station as expeditiously as possible. Not removed from litter till operating station is reached.
2. Mobile operating unit, field hospital, evacuation hospital—
 - (a) Wound cleansing.
 - (b) Operation; methods and indications for.
 - (c) Anesthesia; ether, chloroform-drop method.
 - (d) Roentgen-ray examination.
3. Base hospital—
 - (a) Infections, special treatment for.
 - (b) Complications, treatment of.
 - (c) Roentgen-ray examination.
 - (d) Operations, methods and indications for.

OPHTHALMOLOGY

Instructions in ophthalmology should include the following-named subjects:

1. Methods of testing visual acuity.
2. Methods of testing pupillary reaction. Significance of pupillary abnormalities.
3. The simpler methods of testing the ocular rotations and the associated movements of the eye, including convergence.
4. External examinations:
 - (a) Method of everting the lids.
 - (b) Examination with oblique light. Especial attention to its importance in detecting abrasions of the cornea, corneal ulcers, the presence of small foreign bodies and iritic adhesions. Use of fluorescein.
5. Epiphora and its significance.
6. Inflammation of the lacrimal apparatus.

7. Inflammation of the lids and globe. In general, all cases of inflammation should suggest the following possibilities, arranged in the order of their importance:
 - Glaucoma.
 - Iritis.
 - Conjunctivitis.
 - Foreign body in the conjunctiva.
8. Trachoma and other contagious diseases of the conjunctiva.
9. Importance and significance of bacteriological examination in conjunctivitis.
10. Indications and contraindications for the use of mydriatics and miotics.
11. Wounds of the eye and orbital region.
12. The importance of a thorough examination in every case of injury of the globe.
13. The importance of X-ray examination in all cases when there is the slightest suspicion of the presence of a foreign body in the eye.
14. The use of magnets in military eye surgery.
15. Methods of testing and significance of increased intraocular tension. Glaucoma and its varieties.
16. Simple methods of determining the field of vision.
17. The significance of a double vision.
18. The causes of gradual and sudden loss of vision, with consideration of whether functional or organic.
19. Ocular malingering.
20. Eye symptoms in cases of increased intraocular pressure.
21. Ocular headaches, vertigo, and reflex gastric and nervous symptoms.
22. Ocular symptoms of disease and focal septic areas, as in alveolar abscess or sinusitis.

EAR

1. Foreign bodies in the canal.
 - Furunculosis of the canal.
 - Acute otitis media.
 - Acute mastoiditis.
 - Sinus thrombosis.
2. Chronic otitis media. Polypi.
 - Brain abscess.
 - Bárány tests for vestibular function.
 - Labyrinthitis.

NOSE AND THROAT

1. Acute and chronic tonsillitis.
 - Discussion of tonsil operations. Results of operations in preventing absorption.
 - Peritonsillar abscess.
 - Nasal obstruction.
 - Deviation of the septum. Submucous resection of the septum.
2. Acute and chronic sinusitis.
 - Antrum, frontal, ethmoid, sphenoid—polypi.
3. Epistaxis.
 - Fracture of the nasal bones.
 - Correction of external deformities of the nose.
 - Catarrh.
 - Atrophic rhinitis.
 - Syphilis of the nose and throat.
4. Acute and chronic laryngitis, papilloma of the larynx—cancer.
5. (Optional):
 - Direct inspection of the larynx and trachea.
 - Foreign bodies in the trachea and bronchi.
 - The direct examination of the esophagus.
 - Diseases of the esophagus: Stricture, pouch, cardiospasm, cancer.
 - Foreign bodies in the esophagus.

NEUROLOGICAL SURGERY

Skull—Fractures:

1. Varieties—

- (a) According to mechanism—bending, bursting, expansile.
- (b) Simple or compound.
- (c) According to form of fragments—fissured, linear, comminuted, diastasis, depressed, perforating, gunshot.
- (d) According to situation—vault, base.
- (e) Infection and complications.
- (f) Associated brain injuries.
- (g) Associated injuries to cranial nerves.
- (h) Associated injuries of blood vessels.
- (i) Associated injuries of nasal accessory sinuses.

2. Symptomatology.

3. Prognosis.

4. Diagnosis.

5. Treatment.

Meninges:

1. Physiology of cerebrospinal fluid.

2. Meningitis—

- Traumatic infective.
- Pathology and bacteriology.
- Symptomatology.
- Diagnosis.
- Prognosis.
- Treatment.

Brain:

1. Localization of function—

- (a) Exeitmotor cortex.
- (b) Sensory field.
- (c) Visual cortex.
- (d) Auditory cortex.
- (e) Olfactory cortex.
- (f) Cortical speech centers.

2. Craniocerebral topography.

3. Symptomatology of organic disease.

- (a) General symptoms.
- (b) Local symptoms.

4. Brain abscess—

- (a) Varieties.
- (b) Pathology.
- (c) Symptomatology.
- (d) Treatment.

5. Technic of intracranial operations.

6. Roentgenography and stereoroentgenography in intracranial disease.

Spine:

- 1. Surgical anatomy of vertebral column.
- 2. Normal and pathological physiology of the cord.
- 3. Localization in the cord.
- 4. Symptomatology of spinal disease—
 - Cell destruction.
 - Tract degeneration.
 - Root symptoms.
 - Sensory disturbances.
 - Motor weakness and paralysis.
 - Reflex disturbances.
 - Bladder and rectum.

Spine—Continued.

5. Variations in symptoms according to level.
6. The operative technique of laminectomy.
7. Extraction of foreign bodies.

Nerves:

1. Function—
 - (a) Motor.
 - (b) Sensory—epicritic, protopathic, deep.
2. Results of section of motor nerve.
3. Results of section of sensory nerve.
4. Nerve shock.
5. Diagnosis of nerve lesion (traumatic).
6. Technique of nerve suture.

PLASTIC AND ORAL SURGERY, SECTION OF SURGERY OF THE HEAD

1. Surgical anatomy of the face and jaws, bones, teeth, accessory sinuses, soft parts.
2. Sepsis: Special forms of sepsis related to mouth, face, and neck treatment. Peridental infection. Infection of antrum of Highmore and other nasal accessory sinuses.
3. Wounds and injuries of the face and jaws, with special consideration of injuries by projectiles.
4. Fractures of the jaw bones, with special reference to gunshot fractures. Displacements. Emergency treatment. Special care of patient, tissues, etc. Diet. Special methods of fixation, splints, etc.
5. Treatment of deformities of bony and soft tissues following gunshot injuries of face and jaws. Orthopedic splints. Plastic operations. Grafting of soft tissues, bone, and cartilage.
6. Local anesthesia in surgery of face and jaws.
7. Interpretation of dental and maxillary Roentgenograms.

FOOD AND NUTRITION

1. The scientific background of nutrition.
2. The dynamic effect of the different foodstuffs.
3. The influence of muscular work on metabolism.
4. Complete and incomplete proteins.
5. Accessory foodstuffs.
6. Governmental regulation of food.
7. Feeding of European armies.
8. Protection against spoilage of foods.
9. Gastric digestion in man.
10. Work of the food division, Surgeon General's Office.

ORTHOPEDIC SURGERY

1. (a) The human foot; its physiology, examination, and the significance of its symptoms. (b) The soldier's foot and the military shoe; prophylaxis. (c) The disabilities of the foot arising during military service and their treatment. (Synopsis: A review and an elaboration of the work done in these subjects in the course given in training camps.)

2. Injuries to joints and their treatment. (Synopsis: Also a review and elaboration of the preceding course.)

3. (a) Injuries to joints and their treatment. (b) Special joints—the knee joint, etc. (Synopsis: The general subject will be continued and elaborated, and the special peculiarities of the knee joint and other joints fully discussed.)

4. Positions of election for ankylosis. (Synopsis: The pathological changes leading to ankylosis and the clinical indications pointing to it will be fully explained. The positions of which the various joints are most serviceable will be definitely defined and the reasons for choice of these positions given.)

5. The operative procedures available for restoration of function following failure of repair after nerve injuries. (Synopsis: The difficulties involved in the repair of nerves will be fully discussed and the necessity for painstaking orthopedic care in order to secure a successful result after nerve suture emphasized. As alternative measures, where regeneration has failed to take place, tendon transplantation, tendon fixation, and certain bone operations are available, and their technique will be explained.)

6. Nonunion and malunion. (Synopsis: The various causes for nonunion and malunion will be reviewed and the operative procedures indicated discussed.)

7. Bone grafting. (Synopsis: The danger of operation, and particularly of bone operations, until all sinuses have been closed for at least six months will be strongly emphasized. The indications for bone grafting will be defined and the technique of the various procedures—spinal graft, inlay graft, bone peg—carefully explained.)

8. Methods of fixation—plaster of Paris. (Synopsis: The general principles of fixation will be discussed, and the use of plaster of Paris in military work will be fully covered.)

9. Methods of fixation—standard splints. (Synopsis: The standard splints will be demonstrated and their indications and use carefully explained.)

10. Methods of fixation—nonstandard splints. (Synopsis: Other splints and improvised splints will be demonstrated and their indications and use explained.)

TUBERCULOSIS IN THE SOLDIER

Signs of active lesion. The acute lesion. The chronic lesion; activity in chronic lesions; distinction between acute and chronic lesions by physical signs. Distinction by X ray; bronchopneumonic focus; diagnosis of large lesions, isolated or few in number; tuberculous pneumonia; development of caseous lesions; physical signs of tuberculous pneumonia in first stage, in stage of consolidation; cavity signs; recent cavitation; old and dry or nearly dry cavities. Disseminated tuberculosis; miliary (vascular) disseminations. Peribronchial tuberculosis; physical signs; varieties and prognosis; X-ray diagnosis.

Physical examination in tuberculosis.—Necessity of objective examination in military practice. Importance of cough as aid to diagnosis. Topical variations in physical signs in the normal lung. Marginal sounds. Diagnosis by auscultation; breath changes and their significance; kinds and significance of râles. Rôle percussion plays in diagnosis of chest conditions. Voice transmission; transmission of whisper.

Detection of tuberculosis among soldiers.—Repeated weighing of recruits; those losing weight under training to be specially examined. Tuberculosis usually discovered during an exacerbation; distinction between exacerbation of chronic tuberculosis and incipient active tuberculosis. Rôle of X ray in the diagnosis of tuberculosis. Question of line of duty (Circular 23, Surgeon General's Office, and its interpretation). Infection between adults. What is the danger, if any, of spread of tuberculosis among soldiers from contact with tuberculosis individuals? The hygiene of the tuberculous patient; feeding; indications for rest and exercise; hardening methods.

Examination of the lungs.—Stethoscope; necessary to have a stethoscope which fits the ears; Ford stethoscope; phonendoscope not to be used for routine work. Position of patient during examination. Steps in examination. Inspection; general appearance of patient; general shape of chest; retractions; lagging; diminished expansion; apex beat of heart; pericardial pulsation. Palpation; vocal fremitus; normal variations. Percussion; method; light percussion best; normal variations; outlining of apices by Kronig's method; next to percuss from below upward, comparing sides. Auscultation; best to auscultate from below upward, comparing sides; vocal resonance; normal variations; even pressure of stethoscope necessary; whispered voice transmission; normal variations; breath sounds; instructing patient how to breathe; absence of breath sounds; feeble breathing; rough breathing; harsh breathing; prolonged breathing; normal variations; auscultation from trachea; normal disparity between right and left apex; transmission of breath sounds from trachea; normal disparity between right and left apex; pulmonary râles; extra pulmonary sounds simulating râles; classification, crackling, bubbling (so-called moist or suberepitant râles), sibilant and sonorous râles; gurgling râles; consonating râles; cavity râles; pleural râles. Value of "expiration and cough" in eliciting râles. Check up one phase of the examination with the other. Value of the localization and locality of physical signs.

As much as possible of the instruction outlined above was to be given in connection with the daily hospital routine; set classes and instruction were not to interfere with the efficiency of the hospital work.⁵

As stated above, the officers assigned to hospitals and in the various specialties, by War Department orders were carefully selected.² With few exceptions they were competent in their accredited work, but they were required to perform many other duties in the hospitals in order that they might develop into well-trained and finished medical officers.² The course of instruction quoted above was sufficient to render these medical officers capable of performing the multifarious and important duties of their positions; however, in December, 1917, it became apparent to the Surgeon General that a certain proportion of them were still not fully qualified.⁶ The disqualification was due, in most instances, to physical disability, mental incapacity, temperamental unfitness or slothfulness, or to lack of education or proper training. In some instances, it was only apparent or relative and due to the fact that the individual was for the time being assigned to duty for which he was not adapted.

In order to eliminate from the service officers who were incompetent because of actual physical or mental incapacity, and in order that those incompetent from other causes might be made competent or eliminated, the Surgeon General directed that commanding officers of base and general hospitals list all subordinates whose work was not reasonably good, inform them of the directions of the Surgeon General, make inquiry into each case as to why the work performed was not satisfactory, and to take such of the following steps as was considered necessary.⁷ All those suspected of mental incapacity were to be given a psychological examination on the lines and forms prescribed by the Surgeon General. The mentally capable men were to be tried in assignments other than those in which they had failed in their examinations. Arrangements were to be made with division surgeons and commanding officers of adjacent base hospitals for the temporary exchange of officers, in order that those failing in ward work might have a chance with a field or hospital unit. However, no man was to be exchanged as incompetent until his superior officer certified that he had personally given the man proper instruction in technique and was convinced that the man was not capable of becoming competent in that line of work within a reasonable time. The men exchanged were to be given proper instruction in the methods and details of this new work, and were to be assisted in its performance for a reasonable time so as to be saved to the service whenever possible. Those who, by reason of physical or mental incapacity, viciousness, or laziness, could not be made qualified were to be ordered before a board of officers convened for their discharge from the service under the terms of Bulletin No. 32, War Department, May 24, 1917, paragraph 9, and reported to the Surgeon General as unfit for the military service. Officers found unsuitable for hospital work, but who were qualified for field work were to be reported to the Surgeon General, with recommendations for their transfer to divisions.

INSTRUCTION FOR SUBSTANDARD OFFICERS

The course of instruction prescribed by the Surgeon General on November 1, 1917, for medical officers in hospitals proved too advanced for the effective correction of incompetency, due to defective medical education and lack of knowledge of the basic technique of medical or medicomilitary practice. Therefore, another and simpler course was indicated and prescribed, as given below by the Surgeon General, for officers falling in this category, the idea being to secure for the service every man capable of developing into a useful officer.⁷

* * * * * *

(a) Clinical training will be given each day as follows, unless circumstances render a change advisable. Attendance is compulsory.

Monday: Chest clinic, one hour. Discussion of cases and of manner of their investigation and presentation.

Tuesday: Surgical clinic, one hour. Discussion as above.

Wednesday: Diseases of digestive system clinic. Discussion as above.

Thursday: Fractures and orthopedic clinic. Discussion as above.

Friday: Psychiatric, neurologic, ductless glands clinic. Discussion as above.

Saturday: Medical or surgical, bone and joint clinic. Discussion as above.

(b) Instruction should be given to individuals or to classes small enough to permit of individual instruction by chiefs of service as follows, attendance being compulsory on the part of all substandard men.

Monday (by chief of medical service): On routine and thorough methods of physical examination and history writing.

Tuesday (by chief of surgical service): Similar instruction in relation to surgical cases.

Wednesday (by director of laboratory): On laboratory aids to the ward surgeon; what may be expected from the laboratory, how it may be obtained, what it may mean; preparation of patient.

Thursday (by director of X-ray laboratory): On X-ray aids which may be expected, how obtained, what it may mean; preparation of patient.

Friday (by adjutant or registrar): Preparation and disposal of hospital records. Importance of them and of their completeness.

Saturday: Repetition of most-needed instructions.

(c) Officers of known incapacity or doubtful capacity will, so far and so long as it is possible, be assigned to base hospitals or other units in excess of the quota of real necessity for the purpose of the above instruction and will while there be under constant instruction and will do a full day's work each day under the supervision of an officer of known capacity.

No definite period is set for this training of substandard men to remedy their defects and determine their competence. It should be continued so long as they apparently profit thereby. But an officer who at the end of six weeks of intensive instruction does not give promise of reasonable competence at an early date is not worth continuing in the service.

INSTRUCTION FOR OVERSEAS HOSPITAL PERSONNEL

Previous to this time the personnel of base and evacuation hospitals organized for overseas service had been assigned to military and civilian hospitals adjacent to place of mobilization. Here the personnel in groups of practicable size were given professional instruction in the various departments of the hospitals. In May, 1918, however, it was realized in the Surgeon General's Office that, if the hospital units being organized for our overseas service were to render efficient service when they arrived in France, it would be necessary for both officers and enlisted men to be assigned to hospital work in military hospitals in the United States and continued at this work until ordered overseas.⁸ The policy was therefore developed to send the personnel of these overseas hospital units to general and base hospitals in this country and to assign both

officers and enlisted personnel, except such as were necessary for the administrative functioning of the unit, to temporary duty in base hospitals. In accordance with this policy, overseas hospital units were sent to practically all the large camps on May 3, 1918. On departure of these units others were ordered to the camps to take their places.

SPECIAL COURSES FOR OFFICERS

During the late summer and fall of 1917, schools were established in the important medical centers of the United States for the intensive training of medical officers in the specialties of medicine and surgery. The most important of these were schools of fractures and war surgery, including the Carrel-Dakin method of treating war wounds; oral and plastic surgery; orthopedic surgery; neurosurgery; psychiatry; cardiovascular disease; diagnosis and treatment of pneumonia and tuberculosis. Selected medical officers, recommended by the commanding officer of hospitals were ordered to these schools for courses of intensive instruction, at the completion of which they were ordered back to the hospitals, where they acted as instructors in these specialties to the permanent personnel and to those assigned for instruction.

On November 30, 1917, the Surgeon General sent to hospitals a syllabus containing abstracts of the latest literature of war surgery. Primarily, these abstracts were designed as a basis for the lectures provided for in the Surgeon General's circular letter of November 1, 1917.⁴ The syllabus, supplemented by lantern slides and moving pictures, was forwarded to the principal hospitals in turn. The first pictures sent out were on the treatment of war wounds, the application of splints, and the treatment of burns; many others were prepared and sent out as they became available.⁹

Journal clubs were inaugurated in many of the hospitals and professional papers were prepared and read by members at the meetings of the club, and clinical demonstrations of interesting cases were made. These clubs in many instances served to stimulate and hold the interest of the medical officers and proved of value in disseminating information.¹⁰

In the cantonment hospitals the professional instruction as prescribed by the Surgeon General was open to all medical personnel of the camp, including that of the divisions in training at the camps.

In the summer of 1918, in compliance with instructions from the Surgeon General,¹¹ selected enlisted men of long service and of proved character, and some of the new men who were suitably qualified, were assigned as assistants to the headquarters, registrars, and mess officers of base, general, and other hospitals and were given intensive instruction in these duties for the purpose of training them for commission in the Sanitary Corps, to fill vacancies for those positions in the base and evacuation hospitals for overseas service.

Weekly meetings were held between the commanding officers, the chiefs of services of base hospitals, and all the regimental surgeons, within the area from which the hospitals drew the sick, for the purpose of conferences upon all matters pertaining to admission discharge from the hospitals, and the further general improvement and cooperation of the two branches of the medical service.¹²

When the base hospitals and the general hospitals had become thoroughly organized, many of them became educational centers, where post-graduate medi-

cal schools were conducted, not only for the training of the local medical officers on duty in the hospitals thereof and the hospitals and other medical units in the cantonment, but also for medical officers ordered to these hospitals for courses of instruction from other stations. The courses of instruction given in these institutions usually included the special branches of medicine and surgery, and instruction in the duties of the chiefs of the various services of base and general hospitals. Courses of instruction were also conducted for nurses and enlisted men.¹³

The following courses were given in a base hospital in the late summer of 1918:¹⁴

1. Six weeks' post-graduate school for the officers (one clinic and one lecture daily).^a
2. A course of instruction to the regimental surgeons in training in the camp and base hospital work, the administration of the base hospital and coordination of the duties of a regimental surgeon with the base hospital.^a
3. School for instruction in the diagnosis and treatment of pneumonia.
4. Two lectures weekly to nurses.^a
5. A course in laboratory technique by the chief of the laboratory and his assistants.^a
6. A course in operative and surgical technique for enlisted men.^a
7. Instruction in social hygiene.
8. School of hygiene and sanitation.
9. Courses for the training of chief of surgical services, 30 days.
10. Courses for the training of chief of medical service, 30 days.
11. Instruction for chiefs of laboratories.

OUTLINE OF COURSE FOR CHIEFS OF SURGICAL SERVICE

(a) Relation to hospital administration (6 days):

1. The commanding officer.
2. The adjutant.
3. The ward officer.
4. The detachment.
5. Supplies and property.
6. Notification officer.

(b) Records and reports (2 days, and incidental instruction):

1. The registrar—
 - a. Reports, hospital.
 - b. Filing and indexing of records.
2. The supervisor of records—
 - a. Medical importance to patient.
 - b. Medico-legal value to Government and soldier.
 - c. Statistical importance.
3. Administrative officers—
 - a. Efficiency and rating of officers.
 - b. Efficiency and rating of men.

(c) Special boards and committees (2 days, and incidental instruction):

1. Hospital efficiency board.
2. Disability board—
 - a. Line of duty.
 - b. Surgeon's certificate of disability.
 - c. Limited military service.
3. Consultation board.
4. Aviation and other special boards.
5. Testimony before courts and boards.

^a Training exemplified in previous pages of this chapter.

- (d) Sanitation (2 days):
 - 1. General hospital sanitation.
 - 2. The messes—
 - a. Food.
 - b. Conservation.
- (e) Military instruction (daily):
 - 1. Drill and setting-up exercises (30 minutes).
 - 2. Military courtesies; Manual for Medical Department; Army Regulations; Manual for Courts-Martial; lectures and recitations (30 minutes).
- (f) Organization of the surgical service:
 - 1. Duties of chief of service.
 - 2. Duties of assistants to chief.
 - 3. Duties of ward surgeons.
 - 4. Duties of operating teams.
 - 5. Relations of surgical department—
 - a. Genitourinary.
 - b. Orthopedic.
 - c. Otolaryngological.
 - d. Oral and plastic.
 - 6. Conferences, consultations, clinics, and lectures.
- (g) Surgical objects:
 - 1. Registrants and soldiers in training—
 - a. Rejections of unfit.
 - b. Detection of malingerers.
 - c. Fitting of men—
 - (1) Operative.
 - (2) Nonoperative—
 - (a) Orthopedic.
 - (b) Training in convalescent camp.
 - d. Selection of operation procedures.
 - e. Time and training in convalescence.
 - f. Refusal of operation.
 - 2. Wounded—
 - a. Steps in their care.
 - b. The base hospital.
 - c. The general hospital.
 - 3. Reconstruction—
 - a. Surgical.
 - b. Training.
- (h) Technical problems:
 - 1. Operative technique—
 - a. Preoperative care.
 - b. Postoperative care.
 - 2. Operating teams—
 - a. Operator.
 - b. Assistants.
 - c. Anesthetist.
 - d. Nurses.
 - e. Corps men
 - 3. Sepsis—
 - a. Clinical instruction.
 - b. Courses in antisepsis.
 - 4. Special wounds—
 - a. Didactic instruction.
 - b. Clinical instruction if wounded are returned to hospital from France.

(i) Management of the patients:

1. Admission—
 - a.* Distinction and grouping.
 - b.* Isolation of infections.
2. Discharge—
 - a.* Command.
 - b.* Convalescent camp.
 - c.* Limited military duty.

OUTLINE OF COURSE FOR CHIEFS OF MEDICAL SERVICE

* * * * * *

(f) Organization of the medical service:

1. Duties of chief of service:
2. Duties of assistants to chief.
3. Duties of section supervisors.
4. Duties of ward surgeons.

(g) Methods:

1. The staff—
 - a.* Staff conferences.
 - b.* Individual conferences.
2. The service—
 - a.* Classification and assignment of patients.
 - b.* Discharge of patients.
 - c.* General medical cases.
 - d.* Cardiovascular cases.
 - e.* Lung cases.
 - f.* Neuropsychiatric cases.
 - g.* Communicable diseases.
 - h.* Convalescents.
 - i.* Out-patients.
 - j.* Reconstruction.

(h) Consultation:

1. System.
2. Recording.

(i) Medical instruction—

1. Individual.
2. Clinics, lectures, conferences, digests of medical lectures, etc. (to be conducted by student officers so far as possible).

* * * * * *

(f) Organization of the laboratory:

1. The central laboratory and ward laboratories.
2. Relation to chiefs of service and ward surgeons.
3. Administration of laboratory personnel.
4. Care of instruments and supplies.
5. Keeping of records.
6. Routine work, including—
 - a.* Bacteriology and animal parasites.
 - b.* Serology, Wassermann's, etc.
 - c.* Chemical analysis, urinalysis, and various chemical tests.
 - d.* Test on blood, exudates, etc.
 - e.* Pathological anatomy, gross and microscopical.
 - f.* Post-mortems.
 - g.* Preparing media.

(g) Work, in cooperation with the camp sanitary officers, in the control and prevention of disease, including:

1. Examinations of organizations for carriers of typhoid, meningococcus, malaria, etc.
2. Analysis of water, milk, and various foods.

- (h) 1. Relation of laboratory to department laboratory.
 2. Relation of laboratory to Army Medical School.
 3. Relation of laboratory to Army Medical Museum.

NURSES

The Army Nurse Corps personnel of general and base hospitals were assigned thereto by the Surgeon General. In so doing, an effort was made to select a certain number of nurses who were especially skilled in operating-room technique, the administration of anesthetics, in fracture work, orthopedics, etc., the idea being to use them as instructors for other nurses as well as instructors for enlisted men. This was not always possible, however, and many had to receive their special instruction from practical experience and from medical officers on duty in the hospitals after their assignment thereto.

In some of the hospitals a general course of lectures was outlined and given by the medical officer staff. The following is an example of such a course of general instruction.¹⁵ Two lectures per week were given on Tuesdays and Thursdays for 10 weeks. The lectures covered the period 6.45 to 7.15 p. m.

Tuesday, April 2. Lecture 1: Military point of view in regard to patients.

Thursday, April 4. Lecture 2: Camp sanitation.

Tuesday, April 9. Lecture 3: Typical infectious diseases in this war—enteric fever, dysentery, trench fever, infectious jaundice, malaria.

Thursday, April 11. Lecture 4: Meningitis.

Tuesday, April 16. Lecture 5: Pneumonia.

Thursday, April 18. Lecture 6: Carriers and contacts and their control; and

Tuesday, April 23. Lecture 6: Carriers and contacts and their control—Shick tests, vaccines, isolation periods.

Thursday, April 25. Lecture 7: Character of war wounds; transport from field to base.

Tuesday, April 30. Lecture 8: Operating-room technique.

Thursday, May 2. Lecture 9: Dakin's solution and antiseptics.

Tuesday, May 7. Lecture 10: Preparation and administration.

Thursday, May 9. Lecture 11: Fractures and splints.

Tuesday, May 14. Lecture 12: Infection of wounds.

Thursday, May 16. Lecture 13: Hemorrhage and shock; abdominal wounds.

Tuesday, May 21. Lecture 14: Chest wounds and gas poisoning.

Thursday, May 23. Lecture 15: Utilization of men unfit for active field service, graduated exercises, etc.

Tuesday, May 28. Lecture 16: Shell shock.

Thursday, May 30. Lecture 17: Orthopedics.

Tuesday, June 4. Lecture 18: Care of ear and nose cases.

Thursday, June 6. Lecture 19: Adaptation of field ration to special cases.

STUDENT NURSES

The establishment of the Army School of Nursing was authorized by the Secretary of War, May 25, 1918.^b The plan of the school provided that it should be known as the Army School of Nursing and should be located in the Surgeon General's Office. The course of training to be given in the various base hospitals, each hospital to be a composite unit having its own director, its staff of lecturers, instructors, and its teaching equipment—the course to lead to a diploma in nursing and extended over a period of three years. At the

^b For further details, see p. 441.

time of the signing of the armistice, 5,267 students had been accepted and were on duty in 25 military hospitals.

The course of study and the routine work in wards was in accordance with the requirements of the standard curriculum of schools of nursing, issued by the National League of Nurses in 1918. The time allowed the various subjects was divided between lectures by members of the Army medical staff and class quizzes, laboratory work, and demonstration by qualified nurse instructors.

These student nurses were also given instruction in drill, members of the student companies exercising the function of commissioned and noncommissioned officers.

NURSE ANESTHETISTS

In the fall of 1917, in order to supplement the number of skilled anesthetists in the Army, a number of women contract surgeons were appointed and assigned to duty in general and base hospitals for the purpose of instructing Army nurses in the administration of anesthetics.¹⁶ In most of the hospitals courses were inaugurated, and instruction in this subject was given to certain officers, nurses, and enlisted men.

In August, 1918, a questionnaire was sent to the commanding officers of all base and general hospitals by the Surgeon General. The object of this questionnaire was to gather information concerning the number of skilled anesthetists on duty in each hospital; the types of anesthetics they were qualified to administer; the availability of adequate equipment; whether instruction had been given to officers, nurses, or enlisted men or contract surgeons; other pertinent information.¹⁷

On September 23, 1918, the following letter was sent from the Surgeon General to all commanding officers of hospitals.¹⁸

The division of general surgery has completed plans directed toward strengthening the department of anesthesia in the various military hospitals.

These plans contemplate both improving the administration of anesthetics and assuring a constant supply of anesthetists developed by systematic courses of instruction to commissioned officers, nurses, and enlisted personnel.

It is imperative that every chief of surgical service through the commanding officer should cooperate intensively with the division of general surgery in building up a strong department of anesthesia, in order to guarantee adequate service to the surgical patients, both in the United States and overseas forces.

* * * * *

The duties of the anesthetist shall consist in: (a) Supervision of administration of anesthesia and personal administration when desired or when requested by chief of surgical service. (b) Instruction of commissioned officers, nurses, and enlisted personnel in the fundamentals of anesthesia (pharmacology and physiological action of anesthetics), the art of administration, post anesthetic care and sequelæ, and the indications for and technique of resuscitation.

Instruction will be confined to the use of the open drop-ether and the gas-oxygen methods in the order named. Gas-oxygen should not be taught until ether administration is mastered, and every means should be utilized to emphasize the gravity, difficulties, and dangers of gas-oxygen anesthesia.

This office has been specially requested by the chief consultant in surgery, A. E. F., to group nurse anesthetists into two separate classes: (1) Those who are skilled in drop-ether method and (2) those who are skilled in gas-oxygen.

The length of the course of instruction should not cover more than six weeks. It need be no longer than the aptitude of the pupils demands. Classes should be limited to six pupils so that instruction may be intensive.

As soon as a pupil is found to be qualified, this office should be notified (the form of monthly report to be used is inclosed), and his place as pupil filled by another officer, nurse, or enlisted man selected by the chief of the surgical service. In this way, it will be possible to furnish the overseas forces a constant supply of competent anesthetists, while maintaining a high degree of perfection in anesthetic administration in the United States hospitals.

The supply division of the Surgeon General's Office has arranged to send you a sufficient number of tanks to guard against any interruption in the supply of nitrous oxide or oxygen. You should send tanks to be refilled before your reserve supply is compromised. You are to send your tanks to * * * for refilling.

If one of the gas machines requires repair that can not be made locally, immediate exchange should be arranged through the medical supply depot at New York and the division of general surgery notified.

On the 1st of every month a report made out by the anesthetist should be forwarded through military channels to this office, attention division of general surgery. The report should be made in accordance with the inclosed sample blank, copies of which will be furnished you. It is particularly urged that full, explanatory remarks be noted in the column marked "Remarks." All data on this report pertaining to nurses should be submitted to the chief nurse for her guidance. This report does not substitute for the efficiency report rendered by the chief nurse.

ENLISTED MEN

The basis for the instruction and training in general of enlisted men of the Medical Department was laid down in the Manual for the Medical Department, Drill Regulations for Sanitary Troops, and Mason's Handbook. Commanding officers of units and detachments were given great latitude in the choice of ways and means for training their personnel, and were held correspondingly responsible for the results obtained. These instructions were augmented from time to time by circular letters sent out by the Surgeon General and by department surgeons. The wide scope of the duties performed by the enlisted personnel of these hospitals necessitated a specialization which generally prevented a comprehensive course of instruction for the personnel as a whole.

Many of the base hospitals had their beginning in the small post hospitals, the personnel being increased as expansion of the hospital occurred, and it was generally the case in the early days of organization that the personnel was so small in proportion to the number of patients in the hospital to be cared for, that instruction was limited to vital requisites and consisted of hardly more than the practical experience gained in the general routine duties performed. As the personnel increased coincidentally with the growth and formation of new departments in their organization in the hospitals, it was found that many technically qualified men could be found in the classification of the personnel who could be assigned directly to services, where they functioned satisfactorily without further training throughout the existence of the hospital.¹⁹

Instruction was largely carried out in separate departments of the hospitals and in the main was based on the practical performance of work under the guidance of those responsible for the given department. In this way, large numbers of men, both privates and noncommissioned officers, were trained in special work and made available for the formation of additional units for service at other near-by organized hospitals.

Beginning in the spring of 1918, small detachments of enlisted men under the charge of an officer were assigned to several carefully selected hospitals in Philadelphia, New York, and other places for special training in hospital work.²⁰ These detachments were largely used for assignment to hospital units for overseas service. As each detachment finished its training, or was called to rejoin its organization, another detachment was ordered to take its place.

In some hospitals, for the purpose of training the enlisted personnel, the detachment was divided into five groups, one group being designated for instruction for a certain number of hours each day of the week except Saturday, until each group had covered the entire course.²¹ In other hospitals similar methods were employed, the detachment being divided into eight or nine groups. The following is an example of such a schedule of instruction:²²

	Monday	Tuesday	Wednesday	Thursday	Friday
1 to 2 p. m.	Drill	Drill	Drill	Drill	
5.30 to 6.30 p. m.	School of soldier; personal and field hygiene	Property and property responsibility	First aid and bandages	Nursing	Minor surgery and first aid
6.30 to 7.30 p. m.	Paper work		Ward management	Litter drill	Army Regulations

The following quotation was taken from the annual report of the commanding officer of the base hospital, Camp Custer, Mich., for the year of 1918:²³

Enlisted personnel.—Much attention has been paid to the development of an esprit de corps among enlisted personnel. The personnel was organized into six companies under detachment commander and his assistants, each company directly in charge of a sergeant. Competition between companies has been encouraged, both as to effectiveness in drill and in care of barracks. Barracks are all cubicled with sheets, floors oiled, and individual shelving is being installed as fast as time permits. Instruction has also been given in professional care of patients in wards, various courses having been outlined, based on Mason's Handbook, with modifications after detailed study by medical officers. This teaching has been carried on in wards under the direction of ward surgeons, who have been encouraged to take a personal interest in the teaching of his individual ward personnel. The precise lesson for each day has been indicated and maintained uniformly over the hospital so that when a man was transferred from one ward to another his instruction might go on without interruption. Night men have been instructed together, gathering for the purpose one-half hour before going on duty. Classes in typewriting have been successfully maintained, and soldiers unable to speak or write English have been placed in classes and taught until able to do so. There have been 526 men trained in this detachment and transferred to other organizations and overseas. From time to time the hospital has received additional increments from draft and from the depot brigade. Many of these men were transferred to the hospital detachment because of their demonstrated unfitness for other organizations. A large number of these, however, have been salvaged and after training have proved to be valuable members of the detachment. Others, such as the insane and the crippled, had to be discharged.

In many base and general hospitals schools for noncommissioned officers were established for purposes of instruction of noncommissioned officers, selected privates, and privates first class, having the necessary qualifications

to fit them for the various grades of noncommissioned officers. The following schedule is an example of the noncommissioned officers' course.²⁴

The following hours of instruction for each week, places of instruction, and subjects are designated, beginning Monday, January 21:

Monday	Tuesday	Wednesday	Thursday	Friday
1 to 2 p. m.	11 a. m. to 12 m.	11 a. m. to 12 m.	11 a. m. to 12 m.	11 a. m. to 12 m.
Care of sick; first aid; minor surgery. At hospital	Army Regulations; Manual of Medical Department. At adjutant's office	Property accountability. At property office	Paper work. At sergeant major's office	Pharmacy. At dispensary

Men were selected from time to time from the detachment for the school. Those found unsuitable were promptly relieved.

Special courses of instruction were inaugurated in many of the hospitals for the training of selected enlisted men for various special lines of hospital work, such as operating room and surgical assistants, dental assistants, laboratory assistants, X-ray assistants, anesthetists, dispensary assistants, and ward masters. The following is an example of a schedule of instruction for ward masters and surgical and dispensary assistants. In many of the camps the enlisted men from the field units of the divisions were required to attend these courses of instruction.²⁵

SCHEDULE OF INSTRUCTION

For specially selected men at the base hospital in duties of ward master, surgical and dispensary assistants.

In addition to the hours specified below, a minimum of five hours daily will be required to be spent in practical work in the wards, dispensary, and dressing rooms.

Thursday, Nov. 1:

- 10.30 to 11.30... First aid: Contusions and wounds.
- 1.15 to 2.15..... Nursing: The ward; duties of ward master and nurses.
- 2.30 to 3.30..... Minor surgery: Anesthesia, general and local.

Friday, Nov. 2:

- 10.30 to 11.30... First aid: Hemorrhages.
- 1.15 to 2.15..... Nursing: Ward management and diets.
- 2.30 to 3.30..... Minor surgery: Operating assistants, duties of.

Monday, Nov. 5:

- 10.30 to 11.30... First aid: Dislocations and sprains, diagnosis and treatment of.
- 1.15 to 2.15..... Nursing: Beds and bed making; actual demonstration of.
- 2.30 to 3.30..... Minor surgery: Operating assistants, duties of.

Tuesday, Nov. 6:

- 10.30 to 11.30... First aid: Fractures.
- 1.15 to 2.15..... Nursing: Baths and bathing.
- 2.30 to 3.30..... Minor surgery: Minor operations.

Wednesday, Nov. 7:

- 10.30 to 11.30... First aid: Fractures and treatment of.
- 1.15 to 2.15..... Nursing: Enemata, irrigations, and catheterization.
- 2.30 to 3.30..... Minor surgery: Review.

Thursday, Nov. 8:

- 10.30 to 11.30... First aid: Foreign bodies, ear, eyes, nose, and throat.
- 1.15 to 2.15..... Nursing: External applications.
- 2.30 to 3.30..... Minor surgery: Adhesive straps and strapping.

Friday, Nov. 9:

- 10.30 to 11.30... First aid: Heat and cold, effects of.
- 1.15 to 2.15..... Nursing: Temperature, pulse, and respiration.
- 2.30 to 3.30..... Minor surgery: Splints and immobilization of fractures.

Monday, Nov. 12:

- 10.30 to 11.30... First aid: Insensibility, causes and diagnosis of.
- 1.15 to 2.15..... Nursing: Symptoms, subjective and objective.
- 2.30 to 3.30..... Minor surgery: Surgical dressings.

Tuesday, Nov. 13:

- 10.30 to 11.30... First aid: Convulsions.
- 1.15 to 2.15..... Nursing: Clinical records.
- 2.30 to 3.30..... Minor surgery: Preparation of patient and instruments.

Wednesday, Nov. 14:

- 10.30 to 11.30... First aid: Asphyxia, artificial respiration.
- 1.15 to 2.15..... Nursing: Bandages and bandaging.
- 2.30 to 3.30..... Minor surgery: Review.

Thursday, Nov. 15:

- 10.30 to 11.30... First aid: Poison.
- 1.15 to 2.15..... Nursing: Bandages, demonstrations of.
- 2.30 to 3.30..... Materia medica and therapeutics: Drugs.

Friday, Nov. 16:

- 10.30 to 11.30 .. First aid: Poisoning, treatment of.
- 1.15 to 2.15..... Nursing: Bandages and bandaging.
- 2.30 to 3.30..... Materia medica and therapeutics: Drugs, Army supply table.

Monday, Nov. 19:

- 10.30 to 11.30... Pharmacy: Definitions.
- 1.15 to 2.15..... Nursing: Infection and disinfection.
- 2.30 to 3.30 .. Materia medica and therapeutics: Drugs.

Tuesday, Nov. 20:

- 10.30 to 11.30... Pharmacy: Pharmaceutical operations.
- 1.15 to 2.15..... Nursing: Infection and disinfection.
- 2.30 to 3.30..... Materia medica and therapeutics: Drugs, active principles of.

Wednesday, Nov. 21:

- 10.30 to 11.30... Pharmacy: Official preparations.
- 1.15 to 2.15..... Nursing: Infection and disinfection.
- 2.30 to 3.30..... Materia medica and therapeutics: Active principles and classification of.

Thursday, Nov. 22:

- 10.30 to 11.30... Pharmacy: Nonofficial preparations.
- 1.15 to 2.15..... Nursing: Instruments and appliances.
- 2.30 to 3.30..... Materia medica and therapeutics: Administration of medicines.

Friday, Nov. 23:

- 10.30 to 11.30... Pharmacy: Making preparations.
- 1.15 to 2.15..... Nursing: The operating room and surgical nursing.
- 2.30 to 3.30..... Materia medica and therapeutics: Dosage.

Monday, Nov. 26:

- 10.30 to 11.30 .. Pharmacy: Weights and measures.
- 1.15 to 2.15..... Nursing: Infectious disease, nursing of.
- 2.30 to 3.30..... Materia medica and therapeutics: Dosage.

Tuesday, Nov. 27:

- 10.30 to 11.30... Pharmacy: Prescription filling.
- 1.15 to 2.15..... Nursing: Infectious diseases, nursing of.
- 2.30 to 3.30..... Materia medica and therapeutics: Review.

Wednesday, Nov. 28:

- 10.30 to 11.30... Pharmacy: Incompatibilities.
- 1.15 to 2.15..... Nursing: Infectious diseases, how spread.
- 2.30 to 3.30 .. Hygiene: Disposal of wastes.

Friday, Nov. 30:

10.30 to 11.30--- Hygiene: Disease prevention.

1.15 to 4.15----- Written examination in nursing, first aid, materia medica and therapeutics, pharmacy, minor surgery, and hygiene.

Those passing a satisfactory examination in the above subjects were reported eligible for special ratings.²⁵

The plan adopted by the Red Cross for the organization of its first 50 base hospitals for the Army for overseas duty and of developing these institutions in and around large civilian hospitals and medical schools had for its training object the suitable grouping of qualified physicians and specialists. A less obvious but important result was the selection for these units of a relatively high percentage of enlisted men with college and other special training. Instead of simplifying the process of training, which at first would appear to be the result of the plan, the problem was really made quite complicated, for while the courses in nursing, first aid, etc., ordinarily prescribed for sanitary troops were quickly covered by men with these qualifications, such training was inadequate for the preparation of these men for the special work of a base hospital. Therefore, methods were adopted for meeting these conditions.

The first step taken before the mobilization of the unit was, by means of a questionnaire and a personal interview with each man, the making of a survey of the personnel. The result of this was expressed on a large chart, exhibiting, in parallel columns, the names of the men; their education; their previous employment; their past experience in the Army, in hospitals, in commercial and professional pursuits, etc., and the personal impression of the examiner. This survey was used as a basis for the assigning of men for special training. It often showed in these early Red Cross units a high percentage with college training, including a number of premedical and first-year medical students, graduate students in protozoology, etc., and others with some previous military training, mostly in schools. As a rule, systematic training was not attempted until the men were mobilized and under definite military control. The men were generally divided into detachments, one to remain in camp, which included the necessary camp help, and the other attended hospital.

Each hospital detachment was placed in charge of a medical officer for general oversight and instruction. Special pains were taken in these assignments, first, to limit the number of men in any one place to those who could actually be used as part of the hospital help; and, second, to fit into specially important places men capable of qualifying for them. For the latter purpose the tabulated survey of enlisted personnel was particularly useful.²⁶

The training of the personnel of Base Hospital No. 38, at Philadelphia,²⁷ exemplifies this method, but was probably more thoroughly and completely carried out (not only because of the large number of hospitals available in Philadelphia, but because of the excellent cooperation of those in charge of and the staffs of the hospitals in the city with the medical officers connected with the base hospitals) than was possible generally. Under the direction of the commanding officer and the director of the hospital a fully organized and thoroughly systematized course of instruction was prepared and placed in active and successful operation in October, 1917.²⁷

The various hospitals of the city were approached and each agreed to take a detachment of men for training. From 7.30 a. m. to 2.30 p. m. units of 5 to 10 men were on duty in these hospitals, where they were detailed to wards, dispensaries, operating rooms, and laboratories, and given instruction in caring for the sick and wounded. Some were required to carry stretchers, others ran ambulances, served food, assisted in dressing wounds, performed the function of ward orderlies, lifted and transferred patients, assisted in giving anesthetics, etc. Two to four drivers were assigned to spend their mornings in manufacturing and repair shops learning every detail of motor construction, tire and engine trouble, etc. Four men were sent to hotels and hospitals for kitchen work and to familiarize themselves with practical cooking. While details were sent out as indicated, other squads remained at the armory (the use of which was obtained for the hospital) as guards, performed police duty, cooking, etc., and received their military training.

The following is the schedule of instruction followed:²⁷

SCHEDULE OF INSTRUCTION, OCTOBER 29 TO DECEMBER 17, 1917, BASE HOSPITAL NO. 38

- 7:30 a. m. ----- Small sections (5 to 10 men) sent for practical instruction in hospital work to the following hospitals: Jefferson, Pennsylvania, Polyclinic, St. Agnes, St. Joseph's, Jewish, Samaritan, Frankford, Lankenau. Section of 6 men to Adelphia Hotel for instruction in cooking and kitchen. Above sections reassembled at armory, 2.30 p. m.
- 7:30 a. m. ----- Section sent to motor-repair shops for instruction in operating motors, in tire and engine troubles, and in motor-repair work. Reassembled in armory, 12 noon.
- 10 a. m. ----- Section; guard mount.
- 10.15 to 11.15 a. m. Mason's Handbook for Hospital Corps, Monday, Tuesday, Wednesday. Army Regulations, Thursday, Friday, Saturday.
- 12 noon ----- Lunch.
- 1 to 2 p. m. ----- School of the soldier.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
3.30 to 4.15 p. m. --	Duties of a soldier and special lectures	Section in bandaging and surgical dressing	Medical nursing	Physiology	Section in bandaging and surgical dressing	Inspection
4.30 to 5.15 p. m. --	Bacteriology disinfection; parasitology; hygiene	Drill	Anatomy	Surgical nursing; minor surgery; first aid	Drill	

- 5.30 p. m. ----- Dinner.
- 6.15 to 7.15 p. m. -- French lessons on Tuesday and Thursday.
- 9 p. m. ----- Lights out in squad room (tattoo).
- 10 p. m. ----- Taps.

An important factor in the success of the training as a whole was the competition for promotion. The enlistments were made in the grade of private and it was early announced that promotions would be made on the basis of demonstrated fitness. Evening classes were held in Army Regulations, clerical work, etc., for those who desired to attend, to prepare candidates for the examinations for noncommissioned officers.²⁶

The same plan as that carried out by the base hospital units organized in connection with the medical schools and civil hospitals in the medical centers in the United States was followed by the base and evacuation hospital units organized in the medical officers' training camps and cantonments, in so far as it was possible in the early months of the war, and in May, 1918, this policy was adopted by the Surgeon General, and the personnel of all these units was sent to the various cantonments for training in the cantonment base hospitals.⁸

The evacuation hospitals were organized principally at the medical officers' training camps and at the training camp for medical enlisted reserve units at Camp Crane, Pa.²⁸

The great problem to be solved by these units while undergoing training in the camps involved the development of an organization which would be able to function and carry out the work of an evacuation hospital in active service. This problem was particularly difficult in the early months of the war because neither the administration of an evacuation hospital at the front, its function, nor the scope of its activities was clearly understood in the United States until the summer of 1918. Therefore, data concerning the scope of the work and the requirements which they would be expected to meet were not available.²⁹ It was necessary for those in charge of the training of evacuation hospital personnel to utilize as far as possible such opportunities as were available at near-by cantonment base hospitals for the training of personnel in their professional and administrative duties. Accordingly, arrangements were made with commanding officers of the hospitals to permit a limited number of men to assemble each day to receive instruction in the various departments of the hospitals. This included ward management, nursing, bed making, temperature taking, giving of enemas, anesthesia, sterilization of dressings and instruments, preparation of diets, management of the commissary storeroom, dispensary work, and care of the various classes of property. Instruction was also given to men who were to become clerks in the quartermaster department, medical property storeroom, the record office, the registrar's office, and the receiving department of the hospital.

The instruction of these groups covered a period of three months, and at the end of that time a considerable degree of proficiency had been attained.

To develop the men physically and to instill habits of discipline, formations outdoors were held at different hours of the day. Setting-up drill usually immediately after reveille was required of both officers and men. Foot drill and practice march occupied the forenoon, while various classes were organized for afternoon instruction in first aid, venereal prophylaxis, litter drill, and bearer drill without litter.³⁰

A policy of forming base and evacuation hospitals destined for overseas service, in the medical officers' training camps, and after the preliminary military training (first period of this training) to send the personnel to the general and cantonment hospitals for the purpose of instructing them in hospital work proper, as stated above (second period of this training), was approved May 3, 1918.⁸

No special provision was made at that time for the quartering of these troops at the various camps, and as a result they were, in most instances,

quartered in buildings pertaining to the cantonment hospitals. The increased demand for these units for overseas service in the summer of 1918 made it necessary for the Surgeon General to call to the attention of the General Staff the fact that these units should be regarded as troops for overseas service, temporarily receiving instruction in the various hospitals, and that for the purpose of quarters, etc., came under the category of other mobile sanitary organizations being utilized for overseas service and should not be considered as organizations for the care of sick in hospitals in this country.³¹ It was recommended and approved that 18 evacuation hospitals and 36 base hospitals be kept constantly under training in the general and cantonment hospitals in this country at all times, and that as soon as an organization was ordered abroad another was to be sent to take its place in training. On August 10, 1918, 44 base hospitals and 12 evacuation hospitals were ordered from Medical Officers' Training Camp, Fort Oglethorpe, Ga., to various camps for instruction of the personnel in base hospitals.³¹

The following description and schedule of the training of the personnel of an evacuation hospital was abstracted from the report of the training of one of these units from the time of its organization in the medical officers' training camp until its departure for overseas.³²

The commanding officer, adjutant, quartermaster, and one other medical officer were assigned to the hospital in February, 1918, but no enlisted men were assigned until the March draft. The hospital was organized on March 21, 1918, with a personnel of 4 officers and 170 recruits.

Training began at once. A classification of the men was made in order to try and select those qualified or partially qualified for certain kinds of work, and in this way a certain number of men were found more or less fitted for the duty to which they were assigned.

Seven were selected on account of some previous experience, or on account of an expressed preference for that service, and sent for instruction to the X-ray department of the base hospital at the training camp. This instruction consisted of lectures, quizzes, and practical demonstration, and included instruction in anatomy, physics, reading X-ray plates, dark-room technique, K. W. Waite and Bartlett transformer, and a United States portable unit, which included special practical training in the setting up and taking down of this portable outfit and the workings of the gasoline engine, the taking of Roentgenograms and their development in a portable dark room that was made by the students themselves.

Several enlisted men who had some knowledge of cooking were selected and sent to school for cooks and bakers for instruction. After completing their course of instruction they were appointed cooks in their own organizations and the organization opened its own mess.

As to the adequacy of the training which the personnel of these units received before departing for overseas, where they often were required to immediately proceed to the front and begin active operations, it was certainly, in the great majority of cases (although necessary on account of the existing state of war), entirely too short in time and limited in scope.²⁹ Yet the majority of these units, as well as those of the base hospitals, rapidly became oriented and acquired sufficient additional training upon arrival overseas to creditably perform the

work required of them, as shown by the war histories of these units. In this connection, one commanding officer stated that the 18 enlisted men assigned to a camp base hospital in the United States, in groups of 6 for practical and theoretical instruction in anesthesia, consisting of didactic lectures and quizzes, and watching and commenting on the administration of the anesthetic in operating room, gave the anesthetic to over 5,000 patients without a fatality due to the anesthetic. None of these men had ever been on any duty in a medical school or hospital.³³

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CHAPTER VI

SPECIAL SCHOOLS

ARMY MEDICAL SCHOOL

The Army Medical School was established in Washington, D. C., in 1893.¹ It was housed in the Army Medical Museum, Seventh and B Streets SW.,² until 1910, when it was moved to a building at 721 Thirteenth Street NW.³ Following our entry into the World War, the increase in the Army and the resultant increase in the number of medical officers applying for commissions in the Regular Corps, together with the necessity for the special training of large and increasing numbers of enlisted men as laboratory technicians, and of medical reserve officers in orthopedic surgery and as X-ray operators, which was now attempted, plus the enormous increase in all other activities of the school, rendered this building inadequate. It was found necessary, therefore, to seek more space and, to accomplish this end, the premises at 458 Louisiana Avenue (fig. 26) were rented and fitted up as office rooms, metal and wood working shops, plaster bandage shop, miscellaneous laboratories, drafting and class rooms.⁴ This building, of three stories, a basement, and an attic, contained 16 rooms (not including the attic) and a stable, the total floor space, exclusive of the basement, being 4,800 square feet.⁴ Later, it became necessary to further expand the school by leasing and remodeling the premises at 472 Louisiana Avenue. (Fig. 27.) This building was lighted by windows practically on four sides, and contained approximately 22,000 square feet of floor space.⁴

The primary object of the school, at the time of its organization, was the training, in their multifarious medicomilitary duties, of young medical officers recently commissioned in the Regular corps.² Shortly after its establishment, however, officers of the National Guard and Organized Militia in limited numbers were given instruction at the school.⁵ It was soon found that the plan of commissioning young officers and then assigning them to the school was unsatisfactory, as the students did not show the proper zeal for class standing.⁶ Therefore, beginning in 1905, applicants for commission were sent to the school and given the course of instruction and a final examination at the completion thereof before they were commissioned in the Regular corps.⁷ With the creation of the Medical Reserve Corps, in 1908, it was provided that officers of this corps who applied for appointment in the Medical Corps of the Army might be placed on active duty by the Secretary of War, upon the recommendation of the Surgeon General, and ordered to the Army Medical School for instruction and further examination to determine their fitness for commission in the Medical Corps.⁸

This plan has been followed since, but with the expansion of the Army which immediately preceded and followed the entry of the United States into the World War, the automatic increase in the size of the Medical Corps, and the large increase in the Medical Officers' Reserve Corps, it became necessary to

elaborate the schedule of training. Arrangements were then made for post-graduate instruction for selected medical officers, and for courses of instruction in special subjects for Medical Reserve Corps officers detailed to the school for this purpose.⁹

At first, the course of instruction covered a period of four months;² it was increased from time to time until it extended over a period of about eight months.¹¹ The scope of instruction was likewise increased.¹¹ Beginning with the twenty-first session, on October 1, 1916, owing to the increase in the number of vacancies in the Medical Corps caused by the increase in the Army as noted, it became necessary to change the period of the course of instruction from one eight months' course per year to three courses of about 12 weeks each.¹²



FIG. 26.—Army Medical School, Washington, D. C. Main building

At the time the United States entered the World War, the main purpose and function of the Army Medical School had become: (1) The instruction of medical officers and enlisted men in the special duties connected with their professional activities in the military service, in as large numbers as possible and in the shortest possible space of time. (2) The manufacture of prophylactic antitoxins and other biological products for use in the Army, Navy, and other Government bureaus. (3) Special research investigations relating to the medical service of the Army. (4) Miscellaneous activities, such as physical examinations of officers and enlisted men, and the examination of laboratory supplies and apparatus, with a view to their adoption or rejection for the military service.⁹



FIG. 27.—Army Medical School annex. X-ray, physical chemistry, and supply building

ORGANIZATION AND ADMINISTRATION

The organization of the school now embraced the following: Administration and supply, departments of instruction, vaccine manufacture, research, and other activities.¹³ The personnel at the beginning of the war consisted of the commandant, adjutant, personnel adjutant, supply officer, 20 enlisted men, and 4 civilian employees, who were engaged in the administration of the school, and the faculty, made up of the commandant, who was president, professors, assistant professors, and instructors.

The commandant, professors, and assistant professors were detailed by the War Department from among the officers of the Medical Corps. Special professors were nominated by the faculty with the approval of the Surgeon General from among the distinguished members of the Medical Reserve Corps, and the instructors were officers of other branches of the Army detailed by the War Department to give special courses of instruction.¹¹

The faculty arranged the program of instruction, prescribed the textbooks appropriate thereto, allotted the time devoted to each subject, prescribed, the character and scope of examination, and determined the proficiency of students, subject to the express provisions of law, orders, and regulations.¹¹

The general administration of the school was intrusted to the commandant.¹¹ The adjutant was chosen by the commandant from among the professors and assistant professors; he was the custodian of the records of the faculty, he conducted the correspondence of the school and promulgated the orders of the commandant. The property officer was likewise selected by the commandant from among the professors and assistant professors. He was accountable for all property of the school, made authorized purchases, and certified accounts.

Due to the large increase in the number of students, both of officers and enlisted men, and to the large increase in the size of the detachment of enlisted men on duty at the school, it became necessary to appoint a personnel adjutant soon after war was declared in order to relieve the adjutant of some of his responsibilities.¹⁴

The strength of the Medical Department detachment of enlisted men on June 30, 1916, was 20, all grades. On June 30, 1917, the strength had increased to 39 in the following grades:¹⁴

Master hospital sergeants.....	7
Sergeants, first class.....	4
Sergeants.....	4
Corporal.....	1
Privates, first class.....	6
Privates.....	17
Total.....	39

By June 30, 1918, the strength of the detachment had increased as follows:¹⁴

Joined by transfer.....	427
Enlisted.....	367
Inducted.....	243
Total gain.....	1, 037

The losses during the year were 427, leaving a strength present on June 30, 1918, of 649. This included students as well as men permanently assigned to the school. During the next year there was a gain of 547 and a loss of 1,039, leaving a strength of 157 on June 30, 1919.¹⁵ At the beginning of the twenty-first session the civilian personnel consisted of 4 civilian clerks, including the chief clerk. By June 30, 1917, 2 additional clerks had been added to the force, and in addition a telephone operator, an X-ray technician, a mechanic, a carpenter, and 2 watchmen had been added to the force. The expansion of the activities of the school made it necessary later to increase the number of clerks to 10. Five women laboratory technicians were also employed and rendered excellent service in the laboratories. The increase in the number of branch telephone stations throughout the school, the operation of 4 trunk lines with the main telephone exchange and 4 tie lines with the War Department switchboard, necessitated the employment of 2 telephone operators.

DEPARTMENT OF INSTRUCTION

OFFICERS' BASIC COURSE

The period of the war embraced part of the twenty-first session and the entire twenty-second and twenty-third sessions of the school. Each session, consisting of 12 months, was divided into three sections of approximately 4 months each, during which a complete course of instruction was given. The twenty-first session extended from October 16, 1916, to October 4, 1917, and was divided into three sections as follows: The first section ending February 28, 1917; the second beginning March 14, 1917, and ending June 5, 1917; the third beginning August 1, 1917, and ending October 4, 1917.⁴ The twenty-second session began November 12, 1917, and was divided into three sections, the first beginning November 12, 1917, and ending February 5, 1918; the second beginning March 11, 1918, and ending June 15, 1918; and the third beginning July 10, 1918, and ending October 7, 1918.⁴ The twenty-third session of the school began November 12, 1918, and ended February 1, 1919.¹⁶

MILITARY SURGERY

The course in military surgery consisted of didactic lectures on gunshot, sword, saber, and bayonet wounds, illustrated by lantern slides, skiographs, and pathological specimens.⁴ It embraced the mechanics of projectiles, the different kinds of projectiles used in modern warfare, their effect upon the various tissues and organs of the body at different ranges; complications; the action of explosives on the tissues; the treatment of gunshot wounds and their complications on the battle field and at field and base hospitals; etiology, signs, symptoms, and treatment of traumatic aneurisms; varieties of wounds produced by cutting and penetrating weapons and their treatment, wound infections and their treatment, and statistics of battles and campaigns. To this course was added, in the later sessions, the bacteriology of war wounds, and methods of combating primary and secondary infection; in fact, all the methods which had been devised since the outbreak of the war for treating war wounds, including the preparation of patients for transportation and the statistics of the traumatisms of war, were taught. During the twenty-second session call was

made upon officers who were well known for their special professional qualifications in surgery of civil life and upon officers who had participated in war surgery in France for special lectures on this subject.⁴

ORTHOPEDIC SURGERY

A course in orthopedic surgery was established at the school November 12, 1917, primarily for the training of students sent to the school to receive special training in this subject.⁴ Later, however, it was made an integral part of the curriculum, and the classes taking the basic course at the school were given instruction in this subject. The course included the study of anatomy and surgery of muscles and joints of the upper and lower extremities, back strain, foot strain and deformities, shoe fitting, amputation, splint, brace and plaster technique, and artificial limbs. This instruction was given by lectures and clinics at the Army Medical School and at the Walter Reed General Hospital, Takoma Park, D. C.

MEDICAL DEPARTMENT ADMINISTRATION

The course in Medical Department administration included Army Regulations; the Manual for the Medical Department; customs of the service; current War Department general orders, circulars, and bulletins; and methods of administration, with all blank forms in use.¹⁴ It comprehended in detail:¹⁴ (1) Organization of the Army; territorial departments and tactical divisions; organization and duties of each corps and staff department; military rank, command, and precedence; military discipline, honors, ceremonies, official and semiofficial and personal courtesies and customs. (2) Laws and regulations in regard to the appointment of cadets and officers; promotion, retirement, and resignation; death and burial of officers; personal and efficiency reports; method of obtaining pay, quarters, and all allowances of every kind under each staff department, with all blank forms used. (3) General recruiting service and methods of enlisting at stations, with all circulars, reports, and forms. (4) Descriptive lists: Methods of muster and pay, drawing and issuing clothing and keeping accounts, discharges, and final statements, all allowances of every kind under all departments and blank forms used. (5) All laws, regulations, orders, and methods concerning the Hospital Corps, and the Army Nurse Corps. (6) Regulations: Visual and other physical standards for admission to the United States Military Academy; commissions in line or staff of the Army, promotion from the ranks; reenlistments and promotion. (7) Annual physical examination of officers and tests of field officers; duties of medical officers on all boards of examination, promotion, and retirement, and examination forms used. (8) Laws, regulations, and methods governing vaccination, typhoid prophylaxis, and venereal prophylaxis, with blank forms used. (9) Military correspondence: Forms of letter writing and methods of recording and filing in use in the service. (10) Methods of drawing rations or commutation therefor, and use of the ration under all conditions; purchase; hospital fund, its use, care, and returns; mess management. (11) Post administration: Duties of medical officers; sanitary inspections and reports; sick calls; morning reports; post hospital and general hospital administration. (12) Methods of keeping

register of sick and wounded: Reports, papers, and methods connected therewith, and all forms. (13) Morbidity and mortality rates. (14) Property: Allowances, methods of obtaining, caring for, using, accounting for, and disposing of property of all departments and all forms connected therewith. (15) Methods of purchasing necessary supplies and of having laundry work done.

This course was somewhat condensed during the twenty-second session in order to allow more time for instruction in other subjects.

MILITARY HYGIENE

The course in military hygiene was unavoidably modified in many respects from the pre-war course, owing to the fact that now there were three short sessions instead of one long one.¹⁴ Formerly, the instruction had been mainly by lectures, supplemented by a quiz, but on account of the necessity of crowding so much material into a short time, it was found expedient to resort to the quiz method. Textbook descriptions were subjected to comment and criticism based on the personal experience of the teacher in Panama and in various Army camps. The students were encouraged to relate their own experiences. The course was based on Havard's Military Hygiene. The graduates were well grounded in the essentials of the subject and were able to intelligently take up practical work in the field.

The following subjects were covered, in more or less detail: ¹⁴ (1) Camp hygiene; morbidity and mortality in the military service in peace and war; death rates; admission rates; noneffective rates; rates of discharges for disability; influence of climate, race, age, and length of service; the examination of recruits. (2) Air, its composition and relative humidity; effects of altitude, atmospheric dust, ventilation, air contamination; modern theory of bad effects of ill ventilation, tests for air; amount of space required; air purification; food, including the soldiers' ration; clothing, qualities of textile fabrics, footwear. (3) Posts, barracks, and quarters; construction and care of same; kitchens and mess rooms; the guardhouse; insects and vermin; screening; hygiene of the march; personal hygiene of the soldier; camp sites; their selection and care; improvised and portable barracks. (4) Water supplies; quantity required; methods of examination of potable waters; purification of water (*a*) by heater, (*b*) by chemical means, (*c*) by filtration; the Forbes-Waterhouse apparatus; the Darnall filter; the Lyster water bag; domestic filters; sand filtration; mechanical filtration; improvised filtration. (5) Methods for the disposal of camp excreta; the straddle trench; the pit latrine; the Havard box; postholes; the sanitary trough latrine; disposal of excreta by incineration; disposal of wastes, garbage, and refuse; the company crematory; the rock-pile crematory; lavatories; the disposal of manure. (6) Typhoid fever in the military service; history and importance of the subject; paratyphoid fever; the dysenteries; cholera; diarrhea and other intestinal diseases; methods of spread; methods of control; antityphoid vaccination in the Army. (7) Smallpox; vaccination; the other acute exanthemata; measles; mumps; meningitis; diseases of the respiratory tract; tonsillitis, bronchitis, and pneumonia; chronic diseases in the Army; tuberculosis; heart disease; the hookworm;

skin diseases. (8) Malaria in the Army; the prophylaxis of malaria; mosquito prophylaxis; screening; drainage; brush cutting; prophylactic administration of quinine; dengue; yellow fever; the *Stegomyia* mosquito; insecticides; typhus fever and its prevention; the effects of cold and hot climates.

The textbooks used for the course were:¹⁴ Vedder's Notes on Sanitation; Lelean's Sanitation in War (containing concise and up-to-date descriptions of methods then in use by the British); and Havard's Hygiene, for reference and collateral reading.

MILITARY AND TROPICAL MEDICINE

The course in military and tropical medicine consisted of assigned reading in textbooks, and recitations, supplemented by talks when considered advisable.¹⁴ The course was given at the time and parallel with the course in bacteriology, pathology, and laboratory diagnosis, so that when a disease-producing organism was being studied in one course, that disease was studied in the other course. Special attention was paid to the gross and microscopic study of the tissues in each disease; and many of the recitations were held at the Army Medical Museum where the material in the museum was utilized. The course included: (1) The military aspects of general medicine. (2) The military aspects of tropical medicine. (3) Climate and race; effects of diet, temperature, humidity, and light, acclimatization; prophylaxis. (4) Traumatism; poisons. (5) Enteric fevers, with special reference to the method of handling those diseases in the military service; yellow fever; dengue and allied fevers; bacillary dysentery; Asiatic cholera; leprosy, plague, Malta fever, infectious jaundice; yaws; relapsing fever; syphilis as handled in the Army; typhus fever; sprue; the mycoses, with special stress on sporotrichosis; pellagra; beri beri; amebic dysentery and amebic liver abscess; trypanosomiasis; the leishmaniasis; verruga peruviana and Oroya fever; malaria and black water fever; ankylostomiasis; schistosomiasis; and filariasis.

By a method of exchange of lectures, two or more lectures were given to the class by members of the staff of the Hygienic Laboratory of the Public Health Service.¹⁴ The subjects of the lectures were typhus fever, plague, leprosy, and rabies. The chief of the division of zoology, Bureau of Animal Industry, Department of Agriculture, gave one lecture on what was being done in the way of preserving meat, with special reference to trichiniasis.¹⁴

BACTERIOLOGY, PATHOLOGY, AND LABORATORY DIAGNOSIS

This course consisted of practical laboratory work, the outlines of which were laid down in the instruction sheets issued each day to the students. Reading lessons were also assigned in textbooks, with short talks supplementing the texts when it was considered desirable.⁴

Bacteriology.—Preliminary work on the preparation of culture media; and bacteriological technique, using the proteus group for the purpose.

The colon group; and bacteriological examination of water, based on standard methods of water analysis of the American Association of Public Health, 1912.

Bacteriological examination of milk, based on the standard method of the American Association of Public Health, 1915.

Bacillus typhosus, *B. paratyphosus* A. and *B. paratyphosus* B: The practical isolation from blood, stools, and urine, and their identification, including the preparation of Endo media.

Bacillus dysenteriae: Practical isolation from stools and identification.

The diphtheria group: Practical isolation and identification; Schick test.

Diplococcus pneumoniae: Isolation and identification of the type.

Meningococcus: Isolation and identification.

Streptococcus: Isolation and identification.

Anaerobes: *Bacillus tetani* and *B. welchii*.

Spirochetæ.—The parasitic spirochetes of the mouth; the blood spirochetes; *Treponema pertenue* and *T. pallidum*; study with dark field and in stained smears and sections. Examination of spinal fluid; cell count globulin; Lange's colloidal gold test.

Serology.—Complement fixation, with practical work on the application of this test in the diagnosis of syphilis. Agglutination test for transfusion of blood.



FIG. 28.—Army Medical School. Bacteriology classroom

Hematology.—The principles and preparation of Romanowsky stains. Preparation and examination of fresh and stained smears of normal blood; staining and studying smears of blood in the ordinary blood conditions as leukemias and anemias.

Protozoology.—Study of fresh material of the culture and parasitic amœbas; preparation and study of stained smears of culture amœbæ; preparation and examination of stained smears and tissue sections of the parasitic amœbæ.

Trichomonæ, *Lamblia*, *Trypanosomes*, with a description of their line of descent. Preparation and examination of fresh and stained smears of *Trypanosoma lewisi*, *T. evansi*, *T. brucei*, and *T. gambiense*. Study of stained smears of *Trypanosomes*, including *Trypanosoma cruzi*; staining and studying sections of brain in sleeping sickness; and of brain and muscle from animals infected with *Trypanosoma cruzi*.

Preparation and study of fresh and stained smears from cultures of *Leishmania infantum*; preparation and study of sections of liver and spleen of *Kala azar*; *Babesia bigemina*, and *Theileria*.

The coccidia in feces and in sections of tissue. The blood sporozoa, including preparation and study of fresh and stained smears of *Proteozoa*, stained smears of *Hæmoproteus*;

staining and study of smears of *Plasmodium vivax*, *P. malariae*, and *P. falciparum* staining and study of tissues in malaria; study of urine and tissues in black water fever; Gregarines; Sarcocystis.

The ciliates, with study of fresh specimens of *Paramoecium* and *Myctotherus*; examination of human feces containing *Balantidium coli*, and staining and studying sections of intestine of pig, with ulcers containing *Balantidium coli*.

Immunity in protozoal infections.

Chlamydozoa.—Rabies. Staining and studying sections of brain containing Negri bodies.

While most of the time is devoted to the protozoa parasitic in man, the work is taken up systematically; and there is constant comparison with the protozoa parasitic in lower animals and the free living protozoa.

Helminthology.—Cestodes: *Tænia*; *Hymenolepis*; *Dipylidium*; *Dibothriocephalus*. Study of adult worms and larvæ. *Echinococcus*.

Trematodes: *Clonorchis*; *Opisthorchis*; *Paragonimus*; *Schistosomes*.

Nematodes: *Ascaris*; *Oxyuris*; *Ancylostomum*; *Necator*; *Trichocephalus*; *Trichinella*; *Strongyloides*; *Filaria*.

Annelides: *Nirudinea*.

The course is given systematically, and the work consists in the study of human stools containing ova; study of preserved material and museum specimens; obtaining and studying living material from human beings and lower animals, and the preparation and preservation of material. Constant reference is made to the common occurrence of parasitic worms in lower animals. Special stress is placed on micrometry in this work. The entire life history of *trichinella* (living) is shown in rats; *Hymenolepis nana* (living) is shown in rats; the embryos of *Filaria bancrofti* (living) are shown in human blood; and, wherever possible, living material is used in the work.

Medical entomology.—Crustacea: *Cyclops*.

Arachnidia: *Pentastomida*; *Acarina*, including *Demodicidae*, *Sarcoptidae*, *Trombididae*, *Ixodidae*, *Scorpionidae*; *Aranea*.

Myriapoda: *Chilopoda*.

Insecta: *Hemiptera*, including *Aptera*—*Pediculidae*, *Heteroptera*—*Cimicidae*, *Reduviidae*, and *Homoptera*; *Mallophaga*; *Hymenoptera*; *Coleoptera*—weevils, Spanish fly; *Lepidoptera*; *Orthoptera*; *Diptera*. In the important order *Diptera* are taken up the *Aphaniptera*—*Pulicidae* and *Sarcopsyllidae*; *Pupipara*, *Brachycera*—*Tabanidae*, *Muscidae* (*Stomoxys*, *Glossina*, *Musca*, *Auchmeromyia*, *Cordylobia*, *Galliphora*, *Lucilia*, *Compacomyia*), *Oestridae*; *Nematocera*—*Blepharoceridae*, *Simuliidae*, *Chironimidae*, *Psychodidae*, *Culicidae*. In the important family of the *Culicidae* are studied the *Anophelines*, *Culicines*—*Culex*, *Aedes*, *Mansonia*, and *Taeniorhynchus*. A short time is spent on the *Corethrinæ*, on account of their frequent confusion with mosquitoes.

The work is taken up systematically, and special attention is given to life history, habits, and structure as related to parasitism and transmission of disease-producing organisms. Thus, special study is given to the life history of *Musca domestica*, the part it plays in the transmission of typhoid fever and other diseases, and the methods of fighting it. The work consists of the study of fresh material; obtaining, preparing, and preserving material; and the study of preserved material, models, and museum specimens.

Venomous animals, venoms and antivenoms.—Special study is given to venomous snakes, and museum specimens of the common venomous snakes and the venomous lizard of the United States. Venoms are discussed and the various antivenoms are shown and their use discussed.

The shortening of the time devoted to the course made it necessary to leave out considerable work, including that in general pathology, to which considerable time was devoted in the longer pre-war course.

There are frequent practical exercises, in which the students are required to work out "unknowns" arranged as nearly as possible like the work they may expect to meet in the service.

ROENTGENOLOGY

In April, 1917, when war was declared, the X-ray laboratories occupied the first floor rear of the building at 462 Louisiana Avenue NW., Washington, D. C., and the photographic work of the school was done there. The laboratories consisted of the following sections:¹⁷ (1) Laboratories for patients, where cases referred from the physical examination room, Surgeon General's Office and the attending surgeon's office, were examined. (2) Laboratory for instruction, which adjoined the patients' laboratory. (3) Photographic laboratory. Just before the outbreak of the war these three laboratories were all together, but when the course of instruction

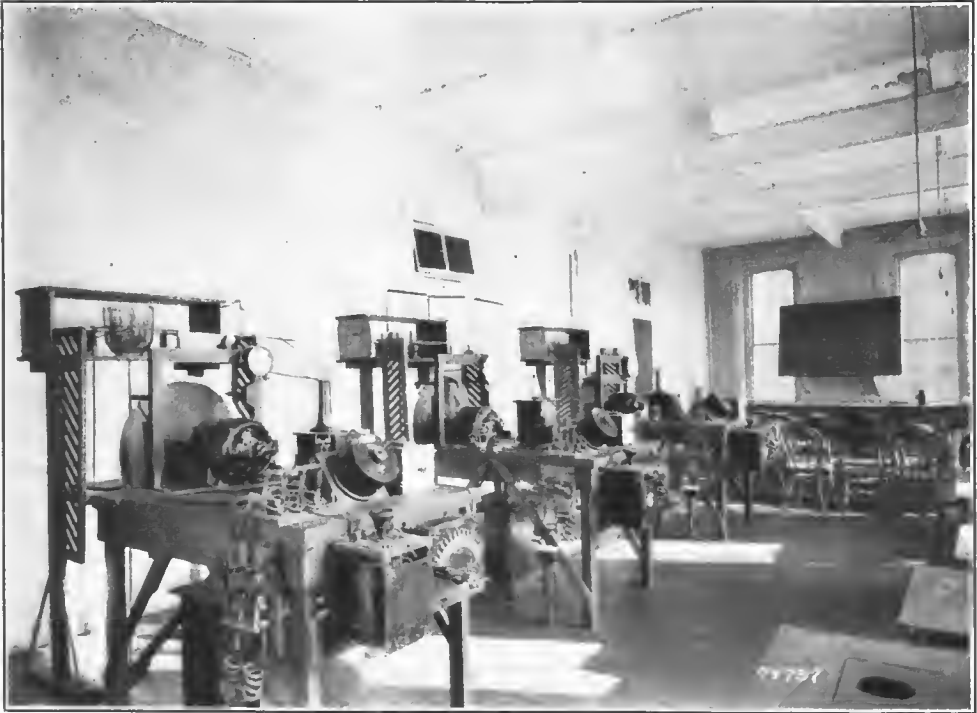


FIG. 29.—Army Medical School. Classroom, X-ray physics

was changed from one class to three classes per annual session, and when in August, 1917, a class of enlisted men was started, it became necessary to rearrange the quarters so that daily classes could be held without interfering with the routine work of the department. This was accomplished by moving the photographic laboratory to the sixth floor, where three well-lighted rooms were available. The space allowed by this change was fitted up with a Waite & Bartlett transformer and other apparatus that was on hand, and a dark room and labyrinth installed, the work being done by the officers and enlisted men of the school, and was used for elementary instruction. In September, 1918, this department was asked to turn out 48 X-ray manipulators a month. In order to do this additional space was secured on the second floor of the orthopedic building, 472 Louisiana Avenue, consisting of 2 dark rooms, in

which were installed 2 developing instruction units, where 16 persons could develop at one time.

The clinical X-ray laboratory was altered by partitioning so that it was possible to secure an office, an additional operating room for dental examination, and a control space for the large operating X-ray and fluoroscopic room. By removing a large labyrinth into the dark room, a plate-loading space was secured which could supply the operators and feed exposed plates into the dark room. A smaller and less elaborate labyrinth was built, connecting these rooms. The plate-examining room, which was quite large, was divided so that a waiting room was secured. This gave more privacy for plate study, which is really the most important part of any laboratory. Special view boxes,

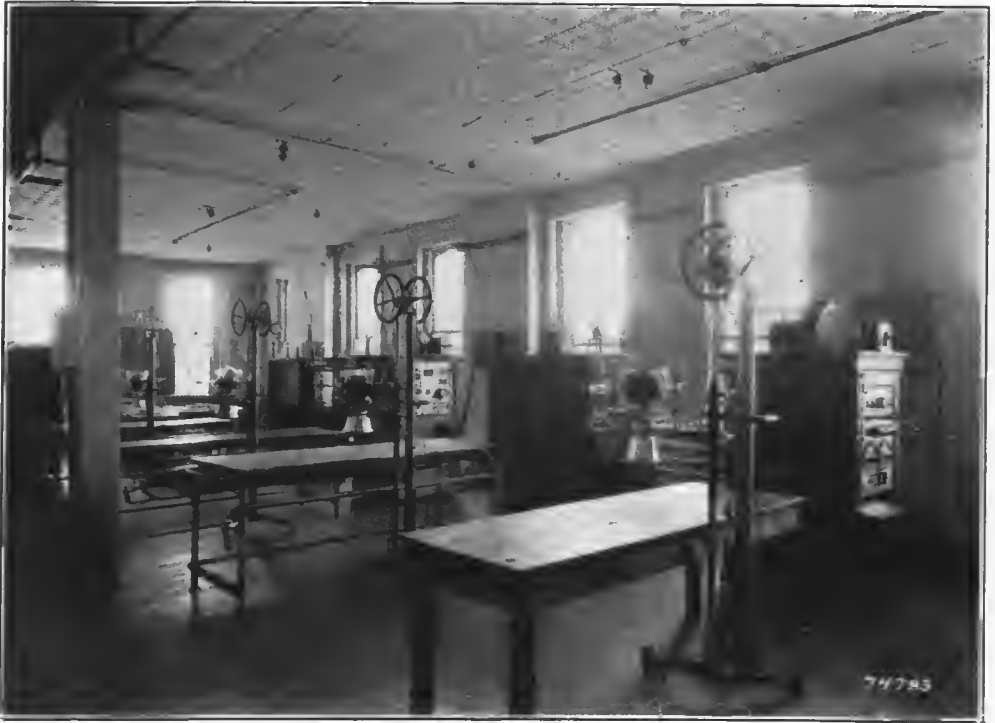


FIG. 30.—Army Medical School. Classroom, X-ray technique

with shelving above and below, were designed and built around the room and were found so satisfactory that the plans were adopted by the Surgeon General's Office for use in other Army laboratories. Plans for these boxes were drawn at the school. Plates were indexed and filed for easy reference and specially arranged for purposes of instruction.

The student candidates were selected from the applicants for the Regular Army who had successfully passed the entrance examinations.¹⁷ They were given one hour a week in lecture and one hour a week in practical laboratory instruction, consisting of the mechanical construction of apparatus, the operation of machines, the localization of foreign bodies, and the practical interpretation of Roentgenograms, with particular reference to the diagnostic points in the pathology of the parts concerned. Special stress was laid on the use of the newer types of apparatus adopted recently for use in the war.

Five classes of student candidates for the Regular Medical Corps, comprising 332 medical officers, passed through the school during the war period.¹⁷

The officers on duty in the Army Medical School, orthopedic section, were given the same general course as the student candidates for the Army and, in addition, special plate interpretation of bone pathology. The officers who reported for duty on tuberculosis boards were given instruction in interpretation of Roentgenograms of tuberculosis. This instruction covered two classes, two hours twice a week for a period of about three months. Eighty-eight officers secured this instruction. Patients referred for examination from the training camp at Fort Myer and other camps near Washington were used for instruction, and the clinical and X-ray evidence compared in the presence of the classes. An outline of the instruction is included:¹⁷

OUTLINE OF INSTRUCTION FOR OFFICERS

LECTURES

1. Electricity, low and high tension current.
2. X-ray properties; X-ray tubes.
3. Apparatus for use in general hospital, base hospital, and evacuation hospital. Portable outfits.
4. Fluoroscopy; Roentgenography.
5. Dangers and precautions.
6. Lantern slide demonstration of positions and technique.
7. Bone pathology.
8. Head and teeth.
9. Urinary tract.
10. Chest.
11. Gastrointestinal tract.
12. Localization of foreign bodies.
13. Review.
14. Examination, written.

LABORATORY

1. X-ray apparatus, Army types.
2. Description and operation of gas tubes.
3. Description and operation of Coolidge tubes.
4. Roentgenography; making Roentgenograms.
5. Protection of patient and operator; testing protective measures.
6. Interpretation of normal bone plates.
7. Plate interpretation; bone pathology.
8. Plate interpretation; head and teeth.
9. Plate interpretation; urinary tract.
10. Plate interpretation; chest.
11. Plate interpretation; gastrointestinal tract.
12. Localization of foreign bodies.
13. Review.
14. Examination, practical.

SANITARY CHEMISTRY

The course in sanitary chemistry consisted entirely of laboratory work, with such preliminary talks by the professor as were necessary to explain the technical procedures. The work of the first section consisted of a review of qualitative and quantitative chemical examination of stomach contents, urine, water, and milk; examination of bleaching-powder samples for available chlorine, and the preparation of Dakin's solution. Courses given in the later sessions were considerably shortened and condensed, but, with the exception of the urine analysis, all phases of the work mentioned above were dealt with.¹⁴

OPHTHALMOLOGY

The course embraced the optical principles included in the mechanism of the eye and optical instruments.¹⁴ This was followed by a study of refraction and more common internal pathological conditions of the eye. This theoretical work was supplemented by practical exercises by the students on the artificial

eye and on each other to learn the various methods of ophthalmoscopic examination; by pictures thrown on the screens, with explanatory talks, illustrating the common retinal diseases; and by cases brought from the Soldiers' Home showing these conditions. Additional clinical material was furnished by the personnel of the school and by the Episcopal Eye and Ear Hospital, Washington, D. C.

SANITARY TACTICS

Instruction in this subject embraced drill, the school of the soldier, the school of the squad, and the school of the company.¹⁴ As far as possible, individual students were allowed to drill platoons and companies and take their



FIG. 31.—Army Medical School. Classroom, chemistry

places as guides, platoon leaders, and company commanders; indoor exercises were also given illustrating maneuvers by the use of wooden blocks; litter drill; lectures on the organization of the Army, the duties of medical officers in the field, the sanitary units, guard duty, etc. Setting-up drill was also given daily at noon in the physical-examination room on the sixth floor. Included in this course were two lectures on military law and courts-martial procedure.

EQUITATION

This course consisted of instruction in nomenclature of the points of the horse and parts of the equipment; method of mounting and dismounting; explanation of the military seat; kinds of "hands," and proper method of

holding reins; "aids" explained and demonstrated; moving to front on straight line and halting; changes of direction to right and to left; work on road at walk; alternate walk and slow trot in hall and on road; suppling exercises; moving to front; halting, changes of direction, shouts; movements by threes in hall; increases and decreases of gaits; work at slow trot and trot; slow trot without stirrups or reins; saddling and bridling; the gallop.¹⁴

During the latter part of 1917 the course in equitation was discontinued and the time which had been devoted to that subject was given to instruction in sanitary tactics.

FRENCH

A course in elementary French was added to the curriculum of the school in 1917 and was discontinued in 1918.¹⁵ This instruction was given by a civilian, a native Frenchman, who was paid by individual subscriptions of members of the class. This course was not compulsory and, owing to a general feeling among the students of the first class that very little was gained by it and the time devoted to it could be used to better advantage with the other studies, the course was discontinued.

INSTRUCTION FOR TRANSPORT SURGEONS

During 1918 a special short course of instruction, in the form of lectures, was given to a group of transport surgeons ordered to the school for this purpose. The lectures covered in a brief way the following subjects:¹⁸ General and military surgery; deafness and speech defects; head surgery and surgery of the nervous system; amputations; Medical Department administration; insanity and functional neuroses; blindness; tuberculosis; paper work.

During the period from October 1, 1916, to February 1, 1919, 377 accepted candidates for the Medical Corps of the Army were ordered to the school.^{14 4} Of these, 355 completed the course and 11 elected not to take the course and did not report to the school; 9 elected to take the course in orthopedic surgery, 1 resigned, and 1 was sent home during the course of instruction on account of inaptitude. Of the number completing the course, 332 were recommended for commission. Of the 9 who elected to take the course in orthopedic surgery, 1 was ordered home before the completion of the course on account of physical disability and 1 was discharged at the end of the course on account of inaptitude, and 7 were recommended for commission in the Medical Corps.

The following is a copy of the weekly schedule of instruction for one week in each of the three sessions:^{19 20 21}

Schedule, second section, twenty-first session, Army Medical School, March 14, 1917, to May 28, 1917

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 12 Bacteriology, pathology, and laboratory diagnosis	9 to 11 Sanitary tactics and drill	9 to 12 Bacteriology, pathology, and laboratory diagnosis	9 to 12 Bacteriology, pathology, and laboratory diagnosis	9 to 12 Bacteriology, pathology, and laboratory diagnosis	9 to 12 Sanitary chemistry
1 to 2 Medical department administration	1 to 2 Surgery	1 to 2 Medical Department administration	1.30 to 3.30 Sanitary tactics, and drill	1 to 2 Surgery	1.30 Equitation at Fort Myer
2 to 3 First section, Roentgenology	2 to 3 Hygiene	2 to 3 Military medicine and tropical medicine		2 to 3 Medical Department administration	
3 to 4 Second section, Roentgenology	3 to 5 Military medicine and tropical medicine	3 to 5 Ophthalmology		3 to 4 Military hygiene	
4 to 5 Third section, Roentgenology				4 to 5 Ophthalmology	

Schedule, first section, twenty-second session, Army Medical School, commencing November 12, 1917

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 11 Bacteriology, pathology, laboratory diagnosis	9 to 11 Drill at Soldiers' Home	9 to 11 Bacteriology, pathology, laboratory diagnosis	9 to 11 Bacteriology, pathology, laboratory diagnosis	9 to 11 Bacteriology, pathology, laboratory diagnosis	9 to 11 Sanitary chemistry
11 to 12 French, section A; French study, section B	11.30 to 12.30 French, section B; French study, section A	11 to 12 French, section A; French study, section B	11 to 12 French, section B; French study, section A	11 to 12 French, section A; French study, section B	11 to 12 French, section B; French study, section A
12 to 12.30 Physical exercises, room 606		12 to 12.30 Physical exercises, room 606	12 to 12.30 Physical exercises, room 606	12 to 12.30 Physical exercises, room 606	12 to 12.30 Physical exercises, room 606
1 to 2 Medical Department administration	1 to 2 Military surgery	1 to 2 Military medicine and tropical medicine		1 to 2 Military surgery	1.30 Equitation at Fort Myer, by platoons
2 to 5 Ophthalmology, lectures and practical work	2 to 3 Military hygiene	2 to 3 Roentgenology (lecture)	2 to 4 Drill at Soldiers' Home	2 to 3 Military hygiene	
	3 to 5 Military medicine and tropical medicine	3 to 4 Medical Department administration		3 to 4 Chemistry (lecture)	
				4 to 5 Medical Department administration and military law	

Practical work in small sections, to be announced, will be given in Roentgenology from 11 to 12 daily. Recitations in sanitary tactics will be held from time to time as announced. The division into platoons for equitation will be announced later. Officers taking the course in military orthopedies will take military drill and all the afternoon courses with the exception of ophthalmology. They will take the practical work in Roentgenology in sections Mondays from 2 to 5, according to later announcement.

Schedule, first section, twenty-third session, Army Medical School, November 11, 1918, to February 10, 1919

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8.50 to 10.50	9 to 11	9 to 11	9 to 11	9 to 11	9 to 12
Drill	Bacteriology, pathology, and laboratory diagnosis	Bacteriology, pathology, and laboratory diagnosis	Bacteriology, pathology, and laboratory diagnosis	Bacteriology, pathology, and laboratory diagnosis	Sanitary chemistry

SECTION WORK IN ROENTGENOLOGY, TUBERCULOSIS, AND CARDIOVASCULAR DISEASES

	11.05 to 11.35		11.05 to 11.35		12 to 12.30
	Physical exercises		Physical exercises		Physical exercises
1.30 to 4.30	1 to 2	1 to 2	1 to 2	1 to 2	1 to 3
Orthopedic surgery	Military surgery	Orthopedic surgery	Orthopedic surgery	Military surgery	Drill
	2 to 3	2 to 3	2 to 3	2 to 3	
	Military hygiene	Military medicine and tropical medicine	Medical Department administration	Military hygiene	
	3 to 5	3 to 4	3 to 4	3 to 4	
	Military medicine and tropical medicine	Medical Department administration	Roentgenology (lecture)	Medical Department administration	
		4 to 5	4 to 5	4 to 5	
		Refraction ^a	Refraction ^a	Refraction ^a	

^a A course of 9 hours in refraction will be given as indicated above from December 4 to December 20.

The practical work in small sections will be posted. Recitations in sanitary tactics and in map reading will be held from time to time as announced.

SPECIAL INSTRUCTION (OFFICERS)

ORTHOPEDIC SURGERY

The section of orthopedic surgery provided a course of instruction in the theory and practice of orthopedic surgery for certain officers ordered to the school for special instruction in this work.⁴ In addition to this, the course was made an integral part of the curriculum of the school, and all officers, including those taking the basic course, and who were candidates for the Regular Medical Corps, were required to take this course of instruction.¹⁴

Officers who were ordered to the school for special training in orthopedic surgery were given, in addition to the training in this specialty during the morning hours, instruction in military drill, and in the subjects taught in the lectures of the regular course during the afternoon hours. These officers were not necessarily candidates for the Regular Medical Corps, but it was considered that the instruction they received was practically the same as that given to the regular classes, and the same standard was maintained for them. They were required to pass the same examination, in the subjects which they were taught, and those successful in these examinations and in the required work

of their specialty were given certificates of graduation. Those graduating, who fulfilled all the other requirements for commission, as to physical qualifications, age, hospital experience, adaptability, etc., were recommended for commission in the Regular Medical Corps.²²

The three-story building at 472 Louisiana Avenue having been leased and placed in condition on July 1, 1918, the orthopedic section was moved to this building.¹⁵ The principal activities were confined to the basement and first floor. Besides the offices and class rooms, the orthopedic annex was provided with shops and laboratories equipped with a motor-driven lathe, combination hand punch and shear punch drill, water-driven emery grinder, work benches, laboratory table, appliances for application of plaster bandages and dressings.

In addition to the commissioned personnel there was assigned to this section an enlisted personnel of 36 men, through whose equipment and qualifications the section was capable of serving a new and most useful function, aside from that of a teaching institution, namely, that of a mechanical unit for such experimental, developmental, and repair work as might be required, not only by the division of orthopedic surgery, Surgeon General's Office, but by the Medical Department as a whole.⁴

The following is a synopsis of the course of instruction:⁴

Anatomy and operative surgery.—

* * * * *

The course in anatomy consisted of didactic lectures on applied anatomy with special reference to operative orthopedics. Special study in muscle function, topography, and distribution of peripheral nerves; gross and special dissection on the cadaver at Georgetown University, accompanied by quizzes and demonstrations; special dissections on all principal nerves; and cross section study.

* * * * *

The course in operative surgery included didactic and practical work on the cadaver at Georgetown University, demonstrating the various new orthopedic operations on bones, joints, tendons, and nerves.

Shoes and feet.—Including the study of component parts of shoes and their functions; the method of manufacture; repair and inspection of shoes for Army use; the application of orthopedic appliances to shoes for correction of deformities; the care of the soldiers' feet in camp and on the march.

Shopwork.—In the shop the officers were taught the construction and production of all types of splints authorized by the department of orthopedics, Surgeon General's Office, beginning with drafting and reading of blue prints, then taking up the construction of the simpler types of splints and later the more complicated ones. This course also included the reconstruction and remodeling of the different types of splints to meet the varied conditions and needs that arise on the field and in camps and hospitals.

Plaster work.—This section included lectures on material; preparation and technique of applying plaster dressings; demonstration and uses of plaster in treating compound fractures and infected wounds of the joints and other uses developed during the present war. All officers under the supervision of the instructor applied casts illustrating all the principles used in the application of plaster.

Clinical work.—This work included diagnosis, treatment, and demonstration of the various military orthopedic conditions on patients at Walter Reed General Hospital and Providence Hospital, Washington, D. C. A number of these cases consisted of war wounds received on the various European battle fronts.

The approximate number of hours devoted to orthopedic surgery in each of the special courses was 419, divided as follows: ⁴

Anatomy and operative surgery-----	Hours 27
Shoes and feet-----	31
Shopwork-----	104
Plasterwork-----	79
Clinical work-----	178
Total-----	419

An example of the weekly schedule of instruction follows: ²³

Schedule for orthopedic sections A, B, C, D, E, F, beginning March 25, 1918

Monday, Mar. 25	Tuesday, Mar. 26	Wednesday, Mar. 27	Thursday, Mar. 28	Friday, Mar. 29	Saturday, Mar. 30
9 to 11.15 Walter Reed Hospital, clinical instruction	9 to 11 Washington Barracks, drill	9 to 11.15 Walter Reed Hospital, clinical instruction	9 to 11 Providence Hospital, clinical instruction	9 to 12 Annex, technique, (shop) A, B, D, E (plaster), C, F	9 to 11.15 Walter Reed Hospital, clinical instruction
11.15 to 12 En route	11 to 11.30 En route	11.15 to 12 En route	11 to 12 En route		11.15 to 12 En route
12 to 12.30 Annex, physical exercise	11.30 to 12.30 Annex, shoes and feet	12 to 12.30 Annex, physical exercise	12 to 12.30 Annex, physical exercise	12 to 12.30 Annex, physical exercise	12 to 12.30 Annex, physical exercise
12.30 to 1 Lunch period	12.30 to 1 Lunch period	12.30 to 1 Lunch period	12.30 to 1 Lunch period	12.30 to 1 Lunch period	12.30 to 1 Lunch period
1 to 2 Army Medical School, Medical Department administration	1 to 2 Army Medical School, military hygiene	1 to 2 Army Medical School, X-ray lecture		1 to 2 Army Medical School, military hygiene	1 to 2 Washington Barracks, drill
2 to 3 Annex, French	2 to 3 Army Medical School, military surgery	2 to 3 Army Medical School, military and tropical medicine	2 to 4 Washington Barracks, drill	2 to 3 Army Medical School, military surgery	
3 to 5 Army Medical School, X-ray laboratory	3 to 5 Army Medical School, military and tropical medicine	3 to 4 Army Medical School, Medical Department administration		3 to 4 Annex, French	
		4 to 5 Annex, French		4 to 5 Army Medical School, Medical Department administration	
		7.30 to 9.30 Annex, anatomy		7.30 to 9.30 Georgetown University Medical School, anatomy	

SPECIAL LABORATORY INSTRUCTION

In addition to the laboratory instruction given to officers and enlisted men who were taking the regular and special courses, groups of officers of the Medical Corps and Sanitary Corps were sent to the school from the Rockefeller Institute of Medical Research for additional laboratory instruction. The course given these officers was of one month's duration, was given each month, and embraced the following subjects:⁴ Culture media; *Bacillus typhosus*; *Bacillus paratyphosus A*; *Bacillus paratyphosus B*; the isolation and identification of these organisms from the stools; dysentery bacillus, pneumococcus, standard agglutination method, anaerobes, staining of tubercle bacilli, gonococcus, malarial parasites. Approximately 250 officers took this instruction during the period of the war.⁴

INSTRUCTION AND PREPARATION FOR FOREIGN SERVICE

In May, 1917, it became necessary to send a large number of medical officers to foreign service; these officers and many more each month thereafter were sent to the Army Medical School to be prepared for such service. Instructions were given them as to uniforms, equipment, finances, etc.¹⁴ They were vaccinated against typhoid and paratyphoid, A and B, and smallpox. Physical examinations were made and they were reported to the Surgeon General when ready for orders. They were furnished with true copies of their orders and given final instructions regarding their arrival at and departure from the port of embarkation.

The training of these officers, as well as that of enlisted men making up units or detachments destined for overseas service in gas defense, was given at Camp Meade, Md., under the direction of the division gas officer of that camp.²⁴ The handling of this work resulted in the establishment of the "foreign-service department," and involved considerable increase in the clerical work of the school. The system of handling these officers was very successful and was continued throughout the period of the war.

GRADUATION

No formal graduation exercises were held during the period of the war. After the graduation of the third section of the twenty-first session, the award of the Sternberg medal was discontinued for the period of the war. The awarding of this medal was resumed at the commencement of the twenty-fourth session, which began October 1, 1919.

INSTRUCTION FOR ENLISTED MEN

COURSE IN LABORATORY TECHNIQUE

Some of the enlisted men of the Medical Department were ordered to the school for instruction in laboratory technique, while others were enlisted at the school for that purpose. They were grouped in three classes:¹⁵ (1) Beginners' class of laboratory technicians; (2) advanced class of laboratory technicians; the beginners' class of laboratory technicians received instruction in the cleaning of glassware, sterilization, the use of the microscope, routine stains and in the bacteriological laboratory. The course was of two months' duration and

was continuous. The advanced class of laboratory technicians received instruction along the same lines as the regular officers' class in the bacteriological laboratory with the addition of instruction in the staining the gonococcus, tubercle bacillus, and the examination of urine. The course was also of two months' duration. A new class was started every two months. Half of the time of these two classes was spent in the chemical laboratory, where they received practically the same instruction as was given the Regular officers' classes, and included special topics in volumetric analysis and certain laboratory methods of the Medical War Manual No. 6, and the sanitary analysis of water and sewage. Approximately 900 men received instruction in these classes and of these, 92 were commissioned as second lieutenants in the Sanitary Corps, and 77 in addition were recommended for commission as second lieutenants in the Sanitary Corps.^{4 15}

X-RAY TECHNICIANS

The need for enlisted X-ray technicians and manipulators in the Medical Department necessitated the establishment of a school of instruction, which was accomplished August 16, 1917.¹⁷ The outline of instruction was as follows:¹⁷

LECTURES

1. X ray in general; excitation tubes in general; tubes, hydrogen, gas, Coolidge.
2. Plates, envelopes, films, screens, cassettes; exposure effects; developer; fixing; plate holder; marking plates.
3. Electricity: Terms and principles; dynamo motors; electricity magnetism; Ohm's law; Lenz's law.
4. Coils; choke coils; transformers; interrupters; rheostats.
5. Exposure factors: Voltage; amperage; time; distance; saturation curve; critical curve.
6. Relation of shadow to radiation; tube shift; shadow traverse.
7. Standard positions; stereoscopy.
8. Fluoroscopy.
9. Use of transformer chart; trouble and trouble hunting; wiring; machines.
10. Troubles and difficulties: Plates—developer; over and under exposure.
11. Lecture on osteology.

LABORATORY

1. X-ray machines; general wiring; trace wiring. Make diagram.
2. Coils and interrupter; saturation curve.
3. Transformer chart.
4. Views of Army Ex. 6: Relation of shadow and direction of radiation.
5. Relation of time of exposure to target.
6. Current and time relation.
7. Voltage law Ex. 9.
8. Making plates of normal parts.
9. Keeping records and clerical work.
10. Weekly written tests are customary. A number of the examination papers are on exhibit.

OUTLINE OF DARK-ROOM INSTRUCTION²⁵

- First period.*—(1) General outline of dark-room procedure.
- (2) Description of a photographic emulsion and effect when subjected to various forms of energy.
- (3) Correct methods of handling plates (reason for).
- (4) Cleanliness and precautions for development.
- Second period.*—(1) Metric system: (a) Linear; (b) volume; (c) weight; (d) temperature.
- (2) Developer: (a) Purpose; (b) ingredients (purpose of each); (c) method of mixing (reasons for); (d) action of.

Third period.—(1) Review of metric measurement.

(2) Fixation: (a) Purpose of; (b) ingredients (purpose of each); (c) method of fixing (reason for); (d) action.

(3) Fog: (a) Definition of; (b) dichoric, (1) reason, (2) characteristics; (c) function; (d) causes.

(4) Stains (reasons for).

Fourth period.—Quiz (oral).

Fifth period.—(1) Developer: (a) Formula; (b) method of mixing.

(2) Dark-room practice.

Sixth period.—(1) Fixing bath: (a) Formula; (b) method of mixing.

(2) Dark-room practice.

Seventh period.—(1) Review of: (a) Developer; (b) fixing bath; (c) mixing of (a) and (b).

2. Dark-room practice.

Eighth period.—(1) Quiz.

(2) Dark-room practice.

Ninth period.—(1) Manipulation of formula.

(2) Dark-room practice.

Tenth period.—Review and oral quiz.

OUTLINE OF WORK FOR MACHINE LABORATORY²⁶

September 24 to 25. Introductory talk covering (a) Coolidge tubes: (1) construction; (2) parts; (3) filament (its significance).

(b) Rectifiers: (1) Construction; (2) principles of operation; (3) purpose.

(c) Transformers: (1) Construction; (2) principles of operation.

(d) Rheostats: (1) Construction, (2) principles of operation.

(e) Autotransformers: (1) Construction; (2) advantages; (3) dangers.

(f) Electrical measuring devices: (1) Ammeter; (2) milliammeter; (3) spark gap.

(g) Electrical units.

(h) Motors and generators, principles, construction, etc. (practical).

September 26 to 27. Tracing wiring and drawing wiring diagram of Waite & Bartlett.

September 28 to October 1. Bedside and base hospital units: (a) general talk of their object, usefulness, and advantages.

(b) Bedside transformer (method by which it produced both high and low tension currents).

(c) Tracing wiring of bedside unit.

(d) Study of changes necessary to operate machine on alternating and direct currents of different voltages.

October 2 to 3. Care of machines: (a) Talk on importance of proper care.

(b) Practical work: (1) Cleaning brushes, commutator, and wiring; (2) oiling motor and generator; (3) care of transformers.

October 4. Trouble hunting: (a) Apparatus will be disconnected or improperly connected and class will be required to locate the trouble.

(b) Use of test lamp.

(c) The following trouble in particular will be put into the machine: (1) Burnt out fuses; (2) dirty brushes; (3) brushes improperly attached; (4) loose connections; (5) broken wires; (6) wires so connected that current attempts to go through tube in the wrong direction.

October 5. Oral quiz.

October 7. Continuation of trouble hunting.

October 8. Transformer charts: (a) Talk on value and usefulness of transformer chart.

(b) Making of transformer chart by the class.

October 9 to 11. X-ray pictures: (a) Talk covering (1) principles involved in taking X-ray pictures, (2) reasons for using different settings, (3) methods of protection.

(b) Taking of pictures by the members of the class.

October 12. Written examination.

October 14 to 15. Anatomy: Study with skeleton of most important bones, joints, etc., in the human body.

October 16 to 17. Continuation of picture taking.

October 17 to 18. Work on alternating current machines: (a) Talk on alternating current machines covering (1) construction, (2) difference between alternating-current and direct-current machines.

(b) Tracing wiring and examining construction of an alternating-current machine.

October 19. Examination covering work of entire course.

GENERAL OUTLINE OF INSTRUCTION OF "THE PORTABLE X-RAY UNIT" ²⁷

September 24 to 27, inclusive. General outline of the portable X-ray unit: (a) Deleo engine (engine end, electrical end); (b) control unit (transformers, boosters, filament control, meters); (c) table (set up and knocked down, tube box, X-ray tube).

September 28. Examination.

September 30 to October 8, inclusive (examination October 5). Deleo plant, detail and principles of the functions and position of each part:

(a) Housing: Engine end, cylinder, cylinder head, oil container, breather tube, carburetor; electrical end (pole shows field windings).

(b) Crank shaft: Fly wheel, Hyatt roller bearing, oil-splash gear, crank where piston rod is connected (piston, piston rings), worm gear, New Departure double roller bearing (oil grooves), armature (commutator, slip rings).

(c) Cam shaft (gear that meshes in the worm gear (on crank shaft) drives this shaft): Eccentrics which operate connecting rods, they the rocker arms, they the valves; end of shaft operates timer; timer.

(d) Electrical circuits: Engine control unit, transformers, boosters, filament control, meters.

(e) Operation of plant.

October 9 to 14, inclusive (examination on October 12):

(a) Practical work (taking down and setting up of engine, taking down and setting up of table, taking pictures).

(b) Trouble hunting.

October 15. Examination or review and bedside instructions with alternating and direct current, 110-220-volt; taking pictures.

Schedule of instruction, school of manipulators ²⁸

Daily except Saturday	Laboratory of electricity	Laboratory portable apparatus	Developing laboratory
8 to 10	A { 1. 8 men 2. 8 men	B { 1. 8 men 2. 8 men	C { 1. 8 men 2. 8 men
10 to 12	B { 1. 8 men 2. 8 men	C { 1. 8 men 2. 8 men	A { 1. 8 men 2. 8 men
1 to 2	Conference of whole class; medical officer in charge		
2 to 4	C { 1. 8 men 2. 8 men	A { 1. 8 men 2. 8 men	B { 1. 8 men 2. 8 men

Forty-eight men; 3 groups of 16; 3 daily periods; 20 working days.

Saturday, written examination or quiz; general police and make-up work.

Ten-minute intervals between the two morning periods.

Groups of 16 to be divided into units of 8 men under the chief instructor and 1 assistant.

These men, upon completion of the course of instruction in X-ray work, were given practical experience by working in the Army Medical School; laboratory for patients, Soldiers' Home; Providence Hospital; George Washington University Hospital; Georgetown University Hospital; Children's Hospital; Episcopal Hospital; and the Walter Reed Hospital, Washington, D. C.¹⁵

Lists of qualified technicians and manipulators were sent to the Surgeon General's Office, X-ray division, for assignment to duty elsewhere.¹⁷ Technicians who showed special adaptability were retained at the school as assistants. Several received commissions in the Sanitary Corps. Upon receiving their commissions they were ordered away from the school and assigned to duty in various capacities, at home or overseas.

Primarily, these men were supposed to be able to care for the X-ray apparatus, to make minor repairs, and to keep the machines running satisfactorily. A number of them thoroughly understood the electrical construction and were able to do almost every kind of repair work. They were usually given assignments where their knowledge was most useful. In this capacity they were called technicians. Secondly, they were instructed in making exposures of patients, developing the plates, and general dark-room work. They were given a little osteology to enable them to intelligently make plates of the parts of the body requested by the surgeon. In this capacity they were called manipulators. They were not supposed to interpret Roentgenograms or to give opinions on plates they had taken.¹⁷ It was not expected that they should in any way usurp the duties of the Roentgenologist.

Certificates of proficiency were given to men who were found qualified to perform this special duty.¹⁷ Enlisted men found disqualified after a fair trial in the classroom were transferred to other duties. Two hundred and thirty-three enlisted men received special instruction in X-ray technique, of which 25 were not found proficient and given other duty. About 175 were given certificates of proficiency, while the remaining 33 were given duty in the X-ray laboratories as assistant and no doubt later were eligible for certificates.

These manipulators and technicians were on duty in most all of the cantonments and camps, and many were on duty in France.

INSTRUCTION IN ORTHOPEDIC WORK

In addition to the 36 enlisted men on a duty status in the orthopedic department on July 1, 1918, 226 additional men reported during 1918 for duty and instruction.¹⁵ These men received instruction in litter drill, first aid, hygiene, anatomy, physiology, Medical Department administration, metal work, shop work, brace work, leather work, plaster work, carpentry work, machine work, blacksmithing. Two hundred and forty-six hours were devoted to this instruction, and as the men became proficient they were promoted to the grade of sergeant or corporal, and were ordered as orthopedic technicians to the several general hospitals.¹⁵ One hundred and eighty-two men were transferred as technicians, 18 as clerks, 44 discharged, and 18 were on duty at the school at the end of 1918.

DEPARTMENT OF VACCINE MANUFACTURE

The manufacture of prophylactic typhoid vaccine was developed in the Army Medical School in 1908, by Russell, and since 1908 this vaccine and other biologic products have been manufactured by the school and furnished to the Army, Navy, Public Health Service, and other Government bureaus.⁴ During 1916, the mobilization of practically the entire National Guard, the increase in the Regular Army and Navy, and the requirement that paratyphoid A and B, as well as the typhoid vaccines, be administered to all those in the military

service, caused by the development of an epidemic of paratyphoid among the American expeditionary forces in Mexico, necessitated an enormous increase in the production of these vaccines.⁴ The declaration of war, with the enormous increase in the military forces by enlistments, the mustering into the military service of the National Guard, and the preparation for the mobilization of the National Army, made it necessary to speed up the manufacture of all biological products to a still greater extent. This was done without delay, and it was always possible to supply all demands adequately.

On account of the epidemic of paratyphoid A in the expeditionary force in Mexico in 1916, experimental work on paratyphoid A vaccine had already been begun in September, 1916, and work on paratyphoid B was taken up as soon as war was declared.²⁹ At first, on account of fear of severe reactions, it was planned to vaccinate separately with typhoid and paratyphoid A and B. This plan was begun in July, 1917, but it soon became evident that this doubling of the work was unnecessary, and the triple typhoid vaccine was prepared and was issued in August, 1917. In June, 1918, lipo-vaccine was issued after experimental work which seemed to show that a single dose of oil vaccine was sufficient to protect. Saline vaccine was discontinued in August, 1918, but was readopted in March, 1919, because it was found that lipo-vaccine was difficult to make in a sterile condition. Either the organisms were not killed, or contamination took place, and it was also found that the protective value was inferior to saline vaccine in animals.

Leutin tests were practically discontinued on account of the difficulty of making material and the uncertainty of the results. The laboratory acted as a supply depot of diagnostic sera, animals, stains, glassware, etc., for neighboring camps and in some instances for the whole Army.²⁹

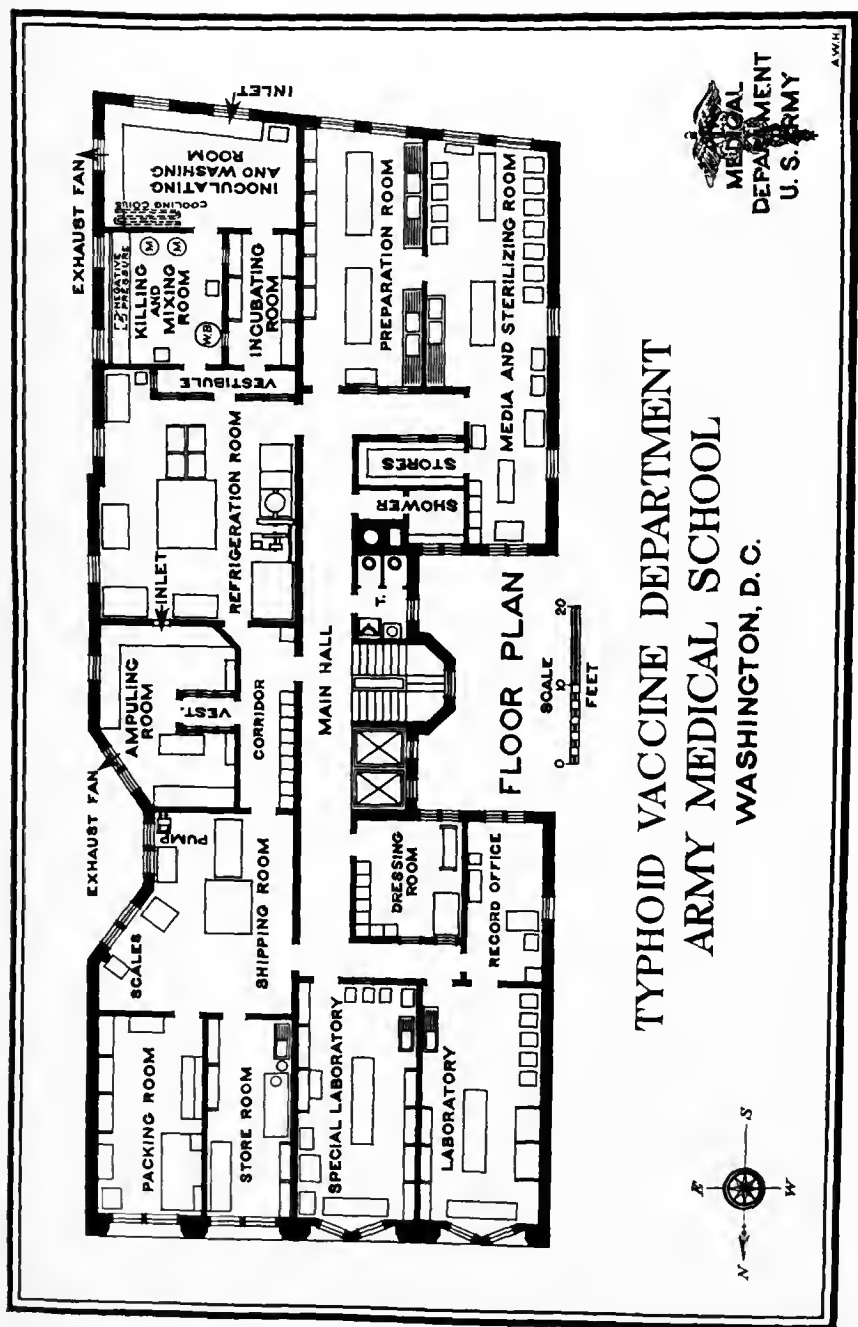
The following shows the amount of vaccine distributed to the Army, Navy, and other Government departments and civilians during the period April 1, 1917, to November 15, 1918:³⁰

	c. c.		c. c.
Plain typhoid vaccine.....	2, 772, 813	Gonococcus lipo-vaccine.....	49, 444
Triple typhoid saline vaccine...	16, 640, 247	Staphylococcus vaccine.....	3, 718
Triple typhoid lipo-vaccine....	1, 528, 385	Streptococcus vaccine.....	3, 310
Paratyphoid lipo-vaccine.....	2, 297, 995	Staphylococcus acne vaccine.....	2, 678
Pneumococcus lipo-vaccine	1, 565, 370	Staphylococcus-streptococcus vac-	
Influenza lipo-vaccine.....	74, 549	cine.....	900
Veterinary lipo-vaccine.....	1, 296, 780		

During the period October 28, 1918, to December 26, 1918, meningococcus lipo-vaccine was distributed to the Army and civilians amounting to 8,202 c. c.³⁰

DEPARTMENT OF RESEARCH

During the year 1918 several officers were engaged on research problems, relating principally to the diseases of soldiers.¹⁵ The most extensive of these was the work on experimental pneumococcus pneumonia in monkeys. Two hundred monkeys were secured for this purpose from the Philippine Islands, through the supply division of the Surgeon General's Office, and the work was considered of fundamental and of practical importance. The work on Xylose fermentation of typhoid bacilli was of scientific and practical value in the typhoid problem in the Army.



Research work was carried on in the chemical laboratories on the chemical and physical action of ultra-violet rays on certain vegetable oils, and the sterilization of oils by means of ultra-violet rays. The following is a summary of the research work done by personnel connected with the pathological laboratories during the fiscal year ending June 30, 1919.¹⁵ Studies on complement fixation, especially the production of amboceptor; studies on deficiency diseases; studies on lipo-vaccine and the production of such vaccines; triple typhoid lipo, triple pneumococcus lipo, triple dysentery lipo, cholera lipo; studies on the Group IV pneumococci; studies on the hydrogenion concentration of media; experimental production of plague vaccine; experimental production of influenza vaccine; studies on the grouping of *B. influenza*; agglutination in animals following lipo-vaccine; studies on pneumococcus saline vaccine; studies on the optimum growth of meningococcus; studies on the production of sera in goats; studies on the effects of lipo-vaccine on the leucocytes; studies in complement fixation with special reference to typhoid and pneumococcus; effect of lipo-vaccine in increasing susceptibility to other diseases; studies on the local reaction in animals against bacterial vaccines; experimental pneumococcus pneumonia in monkeys; prophylactic vaccination, specific treatment; technique of preparation of vaccines. The X-ray department aided in the designing and completing of an X-ray ambulance for the United States Army portable X-ray unit.¹⁵ The ambulance was driven to Ontario, Canada, where it was demonstrated for the benefit of the Canadian Government. The portable field outfit, the portable bedside unit, and numerous other new pieces of apparatus were tested out in conjunction with the duties of the laboratory.

MISCELLANEOUS ACTIVITIES

In addition to the regular courses of instruction, various activities of the school were concerned directly or indirectly in the teaching of officers and enlisted men.

Clinical laboratory.—During the period from January 1, 1917, to December 31, 1918, there were made, among many others, the following examinations and tests:^{4 15} Examinations for typhoid fever, 2,168; animal inoculations for immune sera, etc., 6,162; miscellaneous examinations, gonococcus, etc., 4,088; Wassermann tests, 33,951; treatments with bacterial vaccines, 35,558.

Wassermann tests.—The Wassermann reaction was performed continuously as a diagnostic test for syphilis. During the fiscal year ending June 30, 1918, the total number of Wassermann tests made in the laboratory was 19,524, of which 531 were reexaminations, 16,583 were made in accordance with existing orders calling for a Wassermann test on applicants for commission, enlisted candidates for various service schools, recruits, etc., and 2,461 examinations of new cases. Of the latter, 1,280 were for syphilis or suspected syphilis, and 1,181 were for cases suffering with diseases other than syphilis; in addition, there were 681 tests made for gonococcus fixation, 242 Wassermann's made on spinal fluids in three dilutions.

The following is a summary of analyses and examinations made during the period from June 30, 1917, to June 30, 1919:^{4, 14, 15} Urines, 34,819; water, Army posts, 175; drugs, 13; foods for poisons, 12; water, other sources, 10; stomach contents, 9; miscellaneous, 260.

X-ray clinical laboratory.—The following is a summary of the work of the clinical laboratory of the X-ray department of the school:¹⁷

	September, 1917, to June 30, 1918	July, 1918, to November 30, 1918	Total
Number of patients seen	2,660	1,301	3,961
Radiographs	3,799	3,167	6,966
Dental films	5,325	2,939	8,264 ¹⁰

X-ray photographic laboratory.—The work consisted of taking photographs for the various departments of the school of things of interest to the Medical Department, of preparing lantern slides, and of making prints.¹⁷ Facilities were available for making enlargements and reductions and for copying drawings, tracings, and photographs for the preservation of records. During the year 1917-18 the following amount of work was performed:¹⁷

	September, 1917, to June 30, 1918	July, 1918, to November 30, 1918	Total
Negatives	807	549	1,356
Prints	2,188	1,619	3,807
Lantern slides	1,225	299	1,524 ¹⁰

X-ray testing laboratory.—Anticipating an increase in the experimental and testing work for the Surgeon General's Office (X-ray division), additional space was secured on the third floor at 472 Louisiana Avenue, where electrical control boards were put up for both alternating and direct currents, with recording meters, circuit breakers, etc. The large Delco 3 kw. gas electric set was installed outside, and the small $\frac{3}{4}$ kw. Delco engine set up inside the building.¹⁷ In connection with the testing laboratory, there was erected a dark room for experimental work on plates, chemicals, and the use of new types of ventilators, plate dryers, cabinet, and labyrinths.

Special activities of the X-ray department.—The facilities of the department were at the disposal of the officers on duty in the X-ray division of the Surgeon General's Office, and most of the work was done under their guidance and supervision. Aside from the routine reports on intensifying screens, photographic plates, X-ray accessories, apparatus, and instruments, studies were made concerning the protective value of lead glass, gloves, aprons, fluoroscopic boxes, etc., supplied for use in the Army.

The manufacture of standard Army splints, plaster of Paris bandages, etc.—In addition to the training of officers and enlisted men in orthopedic surgery, splint making, etc., large numbers of the standard Army splints, plaster of Paris bandages, and various other apparatus used in the orthopedic and other services of the Army were manufactured by the orthopedic department of the school and shipped to the various hospitals throughout the service. During the period from June 30 to December 31, 1918, in addition to the other apparatus manufactured, more than 3,100 splints were produced.³¹

Illustrations for lectures by medical officers.—During the year 1917 the school was charged with the arrangements for and the handling of the details in connection with furnishing medical officers assigned as special lecturers at medical schools throughout the country with moving-picture films and lantern slides for use as illustrations for their talks.¹⁴ For this purpose five large moving-picture films illustrating the activities of the Medical Department in the field were sent to the school. Correspondence was kept up with the officers concerned and the itinerary was drawn up. The films and slides were sent by express to various points throughout the country, including New York, Philadelphia, Baltimore, St. Louis, Omaha, Columbus, Buffalo, Syracuse, and other cities.

Physical examinations.—The making of physical examinations during the period of the war was a very important function of the Army Medical School. This work from the beginning was conducted on a scale of considerable magnitude, but its scope so broadened during the progress of the war as to include physical examinations of practically every nature and for every purpose. The amount of time consumed and the labor involved by having these examinations made by one officer and the constant change in detail for the various examining boards appointed made it advisable and necessary to inaugurate a system by which examination could be made systematically and the records secured against loss. Therefore, early in 1917 the service of the Medical Reserve Corps officers awaiting orders at the school for overseas service were secured and utilized to assist in this work, and a regular system inaugurated. By this plan 50 to 100 officers could be examined a day without confusion and the physical examination forms carefully checked and forwarded to The Adjutant General. During the two and a half months from April 15 to June 30, 1917, approximately 1,000 examinations were made, with a constant increase in the number to be examined each day. This work became a function of ever-increasing magnitude, and its scope not only included the physical examinations of officers for promotion and of applicants for the various Officers' Reserve Corps, but also for the determination of the physical fitness of officers for overseas service and the examination of men inducted as privates in the Medical Department. During the year beginning July 1, 1918, and ending June 30, 1919, approximately 13,000 physical examinations were made.¹⁵ Included in this number were physical examinations made for all branches of the service. The majority of applicants in the earlier months of the war were civilian candidates for the several sections of the Officers' Reserve Corps, and, later, with the suspension of hostilities in November, 1918, examinations for this purpose were supplanted by examinations of officers for discharge. The final organization of the physical examination department consisted of an examining team working under the direction and personal supervision of the chief medical examiner. The team was normally composed of 9 medical officers and 5 enlisted men. This number could be increased or decreased quickly and without loss of efficiency to meet sudden and unusual variations in the amount of work thrown upon it from time to time.

Organization of Medical Department units for overseas service.—In addition to the officers and enlisted men sent out from the Army Medical School, both individually and in detachments, for duty in the United States and abroad, four mobile field laboratories were organized and trained at the school and sent overseas. The personnel of these units consisted of 2 officers and 4 enlisted men.³²

ARMY VETERINARY SCHOOLS

It was found that neither the training of enlisted men at the Medical Officers' Training Camp, Fort Riley, Kans., nor the training of officers at the Medical Officers' Training Camp, Camp Greenleaf, Ga., met the needs of a training camp for the Veterinary Corps.³³ The essential requirement was a center wholly given over to the concentration and training of veterinary personnel and for the organization of veterinary units for overseas service. A veterinary hospital and special schools for training noncommissioned officers, farriers, horseshoers, saddlers, teamsters, and cooks were needed.

VETERINARY TRAINING SCHOOL, CAMP LEE, VA.

The establishment of such a school had been under consideration by the Surgeon General for some time, when it received its official impetus from a letter outlining a plan,³⁴ which was forwarded to The Adjutant General of the Army, with recommendation of approval,³⁵ which was received,³⁶ whereupon the Surgeon General announced the following plan for the proposed school:³⁷

* * * * * *

2. The school for Veterinary Corps personnel at Camp Lee, Va., will be known as the Veterinary Training School.

3. Its object is to train officers and enlisted men of the Veterinary Corps and to organize veterinary units.

4. The instruction should proceed along two lines which, though distinct, should be closely correlated: (a) The general military training of the soldier, and (b) the special training required for the veterinary service.

General military training.—As all enlisted men will be recruits, they will need instruction in discipline, school of the soldier, squad and company drill, guard duty, equitation, care of equipment, pistol practice, physical training, personal hygiene, first aid, and the use of gas masks.

Special training.—To prepare them for the special service of the Veterinary Corps, they should at the same time receive instruction in the handling and care of animals, stable practices and management, care of stable and veterinary equipment, care of sick animals in hospitals and elsewhere, first aid and bandaging, administration of medicines, isolation and disinfection in connection with communicable diseases, etc., also in the special duties of farriers, horseshoers, wagoners, and saddlers, and in regard to the paper work of the Veterinary Corps. It is desired that the course of instruction be graded, and that it be uniform for all companies. More advanced courses should be arranged for men of exceptional aptitude who give promise of developing sufficient ability to be considered for promotion to the non-commissioned grades.

5. A period of eight weeks will be allowed for the instruction of the first class to be assigned to the school and for the formation and equipment of the veterinary units named in paragraph 8. The course of instruction should be arranged so that about 90 per cent of the time will be devoted to military training during the first three weeks, after which the time allowed for the veterinary instruction should be increased, at least one-half of each day of the last five weeks being set aside for this purpose. In so far as is possible the classes should be scheduled so that a part of each day will be devoted to classroom work and a part to practical outside work.

6. While the commandant will be responsible for all that pertains to the administration of the school, it is especially desired that the views and recommendations of the senior veterinary instructor, as the senior representative of the Veterinary Corps, be given careful consideration. The highest efficiency can be obtained only by the hearty cooperation of the commandant and the senior veterinary instructor. The senior veterinary instructor is

expected to act as the adviser of the commandant in all matters connected with the school; he is also responsible under the commandant for the veterinary instruction of all of the personnel and will supervise and direct the work of all assistant veterinary instructors, both officers and men. An outline of the subjects which should be included in the course of instruction, showing the time allotted to each, will be prepared and submitted to this office at once, together with a schedule of the classes. Until the base veterinary hospital recommended for Camp Lee is authorized and constructed, the existing facilities of the cantonment may be used for the practical instruction in animal management, care of sick animals, etc.

7. The enlisted men assigned to the school will be organized into eight companies of instruction for the purpose of discipline, drill, training, individual equipment, and subsistence and shelter, with the usual company administration. Each company will have a line officer in command, a veterinary officer, and its pro rata share of the sergeant instructors assigned to the school.

8. The following units are to be organized from the first class assigned to the school: 5 veterinary hospitals (T. O. No. 331); 1 corps mobile veterinary hospital (T. O. No. 109); one-half Army mobile veterinary hospital (T. O. No. 330).

These formations will be organized at the earliest possible date in order that the personnel may have all the opportunity possible to become acquainted with their organization and its duties. In case a sufficient number of men should not be available for the organization of all the above units, those present will be used to organize as many complete units as possible. The assignment of the veterinary and medical officers and of the enlisted men of the Medical Department will be arranged by this office. Further instructions will be arranged by this office. Further instructions will be issued in regard to the authorized hospital equipment.

ORGANIZATION AND ADMINISTRATION

A line officer was detailed as commandant of the school, with the concurrence of the Surgeon General.³³ About the middle of April, 1918, a senior instructor was ordered to report to the commandant of the school for duty, but as there were no school buildings in existence at that time temporary quarters were obtained.³⁵ Between April 14 and 20, 1918, eight veterinary instructors who had received military instruction at the Medical Officers' Training Camp, Camp Greenleaf, Ga., reported for duty at Camp Lee. As none of these veterinary officers had any idea of the kind of work before them, they were taken in hand by the senior instructor, who, for the period of six weeks, by lectures and demonstrations, succeeded in presenting the subject in such a manner that he was reasonably assured of success.

Wooden construction at the service of the school from the beginning included 32 barracks for 52 men each, 8 mess halls for 204 men each, 8 lavatories for 200 men each, 3 officers' quarters for 95 officers, 1 lecture hall, and 1 administration building.³⁸ Two warehouses were available for the supply officer, an infirmary, and a fire house. An exchange was established in a converted dwelling and subsequently enlarged. From time to time further construction was undertaken, using scrap lumber and skilled labor drawn from the enlisted personnel.

The barracks, while sufficient for the housing of the provisional companies, were insufficient to house properly other veterinary units formed. This handicapped the carrying out of that provision for the organization of these formations at the earliest possible date in order that the personnel might have all the opportunity possible to become acquainted with their organization and duties.³⁷ Barracks and mess halls such as were standard in officers' training schools were constructed, but did not fit the tables of organization for veterinary hospital

units, and it was found necessary to house the first units in tents pending their organization by wards. Later, when a school built to accommodate 1,600 men was expanded to a strength of 5,400 without accompanying enlargement in regard to construction of barracks, mess halls, officers' quarters, and lecture halls, it was found necessary for the original allotment of barracks to contain the bulk of the units while the overflow were housed in tents.³⁸

For the greater part of its existence the Veterinary Training School was without hospital facilities; consequently, during this time, practically all veterinary instruction was theoretical; veterinary officers received no practical training in conducting hospitals, or in any part of the administrative work incident to handling sick animals; noncommissioned officers were not trained in directing the work of enlisted men in the feeding, watering, and grooming of hospital patients; farriers had no opportunity to put in practice the teachings of their instructors; enlisted men possessing ability as practical horsemen could be of no assistance in training others deficient in the necessary requisites.³⁸ Presumably labor and lumber shortage accounted for the long delay in building the hospital, construction of which was not actually begun until July 20, 1918.³⁸ It was not complete in every detail even at the time of the signing of the armistice. The actual instruction, however, was carried on despite this handicap.

As soon as the veterinary instruction staff was formed, an equitation class was formed under the tutorship of the senior veterinary instructor. The assistant veterinary instructors assigned to the school composed this class. The first period was held May 28, 1918, and the instruction was continued for two hours each day during the summer. The students were started in the very rudiments of riding, and as they showed progress were gradually advanced until the instructor thought them fit to teach other beginners.

Members of the class were required to know both the theoretical and the practical side of equitation, as the main idea was that they should be able to instruct others. After the usual work at the walk, trot, and gallop, jumping was gradually taken up, until an average jump of between 3 and 4 feet could be taken with the horses at hand. The work in general equitation was continued until the services of most members of the class were required to instruct other classes in riding and horsemanship.

Instruction in equitation was given to 212 veterinary officers, 32 divisional staff officers, 51 medical officers, and 217 enlisted men.³⁸

Line officers were assigned as instructors to the school, despite its character as a center primarily of veterinary instruction, for purposes of administration, discipline, and drill, the building up of units which, while efficient in their chosen work, should be as strictly military as those of the line. The Tables of Organization provided for units that had to be handled with the care and precision of Infantry companies, that required setting up, instruction in marching, pack making, tent pitching, personal hygiene, and care of equipment, military discipline, and courtesy.³⁸

At the time the school was organized, there were available for duty line officers who were graduates of the second officers' training camps at Plattsburg and Fort Myer, who had been serving as attached officers in the 79th Division at Camp Meade, Md. These had undergone three months' intensified train-

ing in the officers' camps and had served more than three months in the division. They had thus gained sufficient experience, under the exigencies of the existing emergency, to qualify them, in the opinion of the division chief of staff, for the work at the Veterinary Training School.

The authorized training cadre consisted of the following officers and enlisted men:³⁶ 1 colonel or lieutenant colonel, line officer, as commandant; 1 captain or lieutenant, National Army, as adjutant; 1 major, Medical Corps; 9 veterinarians, majors, captains, or lieutenants, as instructors; 9 captains or lieutenants, National Army, to command companies; 1 captain, Quartermaster Corps, for supply duty; 1 lieutenant, Quartermaster Corps, for supply duty; 3 sergeants, Quartermaster Corps, 1 sergeant as sergeant major; 2 corporals as clerks at headquarters; 58 sergeants as assistant instructors; 20 cooks; 1 horseshoer; 1 saddler.

The 101 sergeants, corporals, farriers, and cooks who constituted the enlisted training cadre were transferred to the school from line outfits.³⁹ Details of these noncommissioned officers policed camp, improved sanitary conditions, cleared drill fields of vegetation, drained swamps, and cut and burned tangled underbrush.

In September, 1918, the following personnel was authorized to replace the list of permanent personnel set for the above:⁴⁰

(a) Personnel for training school: 1 colonel or lieutenant colonel, line officer, commandant; 1 captain or lieutenant, line officer, as adjutant; 1 major, Medical Corps, surgeon; 10 veterinary officers, majors, captains, or lieutenants, as instructors (includes 1 officer for horseshoeing instructor); 9 captains or lieutenants, line officers, to command companies; 1 captain, Quartermaster Corps, for supply duty; 1 lieutenant, Quartermaster Corps, for supply duty; 3 sergeants, Quartermaster Corps; 1 sergeant, first class, Veterinary Corps, as sergeant major; 8 sergeants, first class, Veterinary Corps, as assistant instructors and acting first sergeants; 1 sergeant, first class, Veterinary Corps, personnel sergeant; 51 sergeants, Veterinary Corps, as assistant instructors (including 1 as saddler instructor); 1 sergeant, Veterinary Corps, as provost sergeant; 1 sergeant, Veterinary Corps, in charge of post exchange; 1 sergeant Veterinary Corps, personnel duty; 2 corporals, Veterinary Corps, clerks; 20 cooks, Veterinary Corps; 1 horseshoer, Veterinary Corps; 1 saddler, Veterinary Corps; 2 privates or privates first class, Veterinary Corps.

(b) Personnel for veterinary hospital: 1 major or captain, Veterinary Corps, as commanding officer; 1 lieutenant or captain, Veterinary Corps, as adjutant and detachment commander; 1 lieutenant or captain, Veterinary Corps, as supply officer; 3 lieutenants or captains, Veterinary Corps; for ward service; 1 sergeant, first class, Veterinary Corps; 5 sergeants, Veterinary Corps; 5 corporals, Veterinary Corps; 2 cooks, Veterinary Corps; 10 farriers, Veterinary Corps; 1 horseshoer, Veterinary Corps; 1 saddler, Veterinary Corps; 4 wagoners, Veterinary Corps; 17 privates, first class, Veterinary Corps; 34 privates, Veterinary Corps.

April 16, 1918, the commandant and 12 officers (10 line, 2 of the Quartermaster Corps) arrived to assist in organizing the school.³⁹ The construction was probably 20 per cent complete; no plumbing had been installed and quarters contained no windows. An adjutant was detailed and suitable noncommissioned officers selected as sergeant major and clerks. With their assistance the organization of headquarters proceeded. Pending receipt of recruits, all enlisted training cadre men at hand were assigned to the First Provisional Company, employed in general fatigue work.

Provisional companies were organized, a line officer commanding each, and veterinary officers assigned equitably for instruction as they reported.³⁹ A like distribution of training cadre noncommissioned officers was made. Various schools for specialists were created, and instruction of classes commenced.

On May 21 the order assigning the officers and men to the various provisional companies was issued from headquarters.³⁹ At the same time the noncommissioned officers were assigned, and there was a tentative assignment of veterinary officers to the eight companies. After the order was issued the noncommissioned officers, cooks, and farriers reported to their respective company commanders at barracks. The tent camp was abandoned. The work of organizing the companies began immediately, and on the 1st of June they were ready to receive the allotment of men who began to arrive at that time.

INSTRUCTION

Courses of instruction comprised veterinary and military work, the former, of course, being considered the more important because of the nature of the troops to be turned out.⁴¹ In the interests of producing disciplined and manageable units, however, at the earliest possible moment, the military work received the greater emphasis in the opening stage of the school's work, the veterinary instruction gradually growing in importance until the two courses divided the time about equally. The schedules provided for a 44-hour week, and they were adhered to carefully until the appearance of the influenza epidemic demanded a general cut in all work.

Military instruction as provided for by a condensed schedule from the Surgeon General's Office included the following subjects:⁴¹ Articles of War; military discipline and courtesy; uniforms and equipment (issue, care, and use); personal hygiene; school of the soldier; school of the squad; school of the company; physical training; guard duty; equitation; pistol (nomenclature, care of, manual, practice on range); first-aid; pack making; tent pitching; gas poisoning and use of gas mask; inspections; singing; lectures. All these subjects were thoroughly taught with the exception of the pistol. It was found impossible to obtain pistols and the instruction in this respect was theoretical and conducted by the company commanders with the assistance of experienced training cadre sergeants.

The general veterinary instruction of officers and enlisted men was conducted, to a large extent, in the open under improvised sunshades; during inclement weather the lecture hall and mess halls were utilized and later the auditorium of the Young Men's Christian Association.⁴¹ While much of this instruction had, of necessity, to be theoretical, due to the lack of a veterinary hospital, every effort was made to introduce into it the practical element so essential to the thorough understanding of the subjects presented. A haltered horse was kept before the classes at all talks, demonstrations, and lectures, and advantage was taken of the facilities offered for practical instruction by the auxiliary remount depot and stables in the vicinity of the school.

OFFICERS

Officers were trained in the following lines:⁴¹ Organization and object of the Veterinary Corps; instruction of enlisted men; military veterinary sanita-

tion and police; post-mortem examination; control of communicable disease, special attention being given to glanders, mange, and influenza; construction of temporary shelters and corrals; the proper shoeing of public animals; dipping tanks, their use and upkeep; military correspondence; requisitioning for veterinary supplies; veterinary reports and returns; Special Regulations No. 70 and Changes No. 1; accountability and responsibility; memorandum receipt; customs of the service; routine stable management; feeds, feeding, and watering; care of animals in the open; transportation by sea and rail; Army Regulations; general and special duties of veterinary officers; saddles and bridles; equitation, elements of; esprit de corps.

NONCOMMISSIONED OFFICERS, FARRIERS, AND FIRST-CLASS PRIVATES

In addition to the general course for the enlisted personnel, selected men were given the following special course:⁴¹ Elementary equine anatomy; physiology, popular form; elements of pharmacy and materia medica; administration of medicines; minor surgery; lameness and its diagnosis; temperatures and use of thermometer; bandaging and dressing; suturing and ligation; veterinary first aid; care of instruments and supplies; sanitation of wards and corrals; responsibility for public animals; memorandum receipt; methods of securing animals for operations; humane handling of animals; respect for military authority; prompt and cheerful obedience; discipline of men; personal appearance and pride; organization and duties of the Veterinary Corps.

GENERAL ENLISTED PERSONNEL

The enlisted personnel received instruction in the following subjects:⁴¹ Exterior of the horse; stable management; haltering, tying, grooming, bedding; feeding, watering, salting, exercising; animals on the march; picket lines and corrals; horse clothing; care of the feet, scratches; pulse and respiration; communicable diseases, dangers of; transportation of animals; improvising shelters; conservation of forage; bran mashes, chop feed, night watering; simple wounds; bridles, saddles, and blankets; the pack saddle and mounted kit; saddle and collar galls; veterinary first aid; the age as indicated by the teeth; fitting of harness; organization and duties of the Veterinary Corps; discipline.

Horseshoers.—Men selected for horse shoers were given intensive training at the Auxiliary Remount School under the supervision of a veterinary officer detailed from the school.⁴¹

Horseshoeing school.—The horseshoeing school was organized July 23, 1918. The object of the school was to instruct and qualify men in horseshoeing for the various Veterinary Corps units which were fast being organized and equipped for overseas service. On account of the lack of facilities and equipment for conducting the horseshoeing school on the Veterinary Training School premises, the men were instructed at the Remount School at Camp Lee, but under the supervision of the Veterinary Corps of the Veterinary Training School. The graded course of instruction could not be followed, owing to the fact that the various units were prepared on such short notice and time did not permit of carrying out the routine as per schedule.

Wagoners.—As many of the men were well accustomed before entering the service to driving two or more animals in harness, no difficulty was experienced in securing and instructing a sufficient number of competent wagoners.⁴¹

Saddlers.—The tables of organization for the units to be sent overseas called for saddlers, and it was therefore necessary to start a school for the instruction of men in this line of work.⁴¹ A temporary shed was built on the rear of the warehouse building, and a school started in the early part of June, 1918. A few saddlers' kits, leather, rivets, etc., were obtained from the supply officer, and a saddler was assigned to give instruction to the men. The school was started with an average attendance of 20 men, and during the existence of the Veterinary School a like number of students was under training at all times. The instruction consisted principally in making wax ends, sewing, reveting, repair work, etc., although some of the more apt pupils were allowed to attempt new work. The main object of the school, however, was to train the men to care for and repair the leather equipment of their respective units when ordered overseas.

Equitation.—Horses were obtained and, after procuring the other necessary equipment, including regulation Cavalry bridles, McClellan saddles, etc., compulsory attendance of the veterinary officers was required at classes from 7 to 9 or 9.30 a. m. each day, depending upon the balance of the schedule.⁴¹ These classes proved highly beneficial, and at the end of several weeks' training the officers were considered capable of taking the mounted classes and teaching them the fundamental principles which a mounted man must know to be able to ride with the proper degree of comfort and safety.

Following talks on the handling, care, and treatment of mounts, with emphasis on the fact that few horses are really vicious and are apt to react to the disposition and temper of the rider, the classes of veterinary officers and enlisted men were given instruction in and required to know by name every part of the bridle, saddle, and mounted equipment used, following the outline exactly as laid down in Cavalry Drill Regulations. Having mastered this, they next received individual instruction in folding blankets, saddling, bridling, and biting a horse properly and in acceptance with the same regulations. After two or three periods devoted to this work, each man's equipment was inspected as he took his place in line, and those unable to adjust it properly and find their places in line within the 10 minutes' time allowance were placed in an awkward squad and there held until proficient. Next the pupils were taught how to hold the reins, to lead out and to stand to horse, how to grasp the reins when the hands were placed on the saddle pommel and on the neck preparatory to mounting and dismounting, the position of the hands and reins mounted, and the use of the aids in starting and halting from a walk. This was taught in the stable corrals where animals could be easily controlled, and further instruction, except unsaddling, tying of horses on picket line, proper care and return of equipment, was given in the field on the circle.

Groups of from 5 to 10 students were taken in charge by each instructor and during the first three weeks worked largely on the circle, perfecting the seat, use of aids in turning, starting, and stopping the animal, and in changing to and through the different gaits. During the first week the work was nearly

all done at a walk, and the men were constantly cautioned to hold the reins correctly and remember the following six points: Body loose, hands down, thumbs up, elbows in, legs back, heels down. The Samur seat, used in the French Army cavalry school and later adopted by our own mounted service school, was the only one taught, and with the advantage of always having the legs on the horse undoubtedly prevented many falls.⁴¹

As soon as the men were individually and collectively able to handle the mounts properly, mounted drill formations and road rides were employed to smooth out and perfect the points taught, and these soon accustomed the riders to the faster gaits. The next thing taken up was the jumping of hurdles from 1 to 4 feet in height, and ditches 3 to 4 feet wide. This necessitated considerable care, as the horses as well as the men had to be trained gradually. None of the 125 animals were schooled jumpers, having been picked up out of the Cavalry corrals, but they proved, with a very few exceptions, to be well suited to all kinds of work.

In August, 30 new flat French training saddles were received and the men had an opportunity to use these in addition to the McClellan.⁴¹ Cross-country rides over a regular course on Sundays were encouraged, and a ribbon was awarded as a prize to the winner.

MILITARY TRAINING

Schools for the instruction of the veterinary officers in matters purely military had been built up to meet a very obvious need. The first contingent of these officers came to the school much better prepared in this respect than was the case in subsequent outfits.⁴² Furthermore, arriving as they did well in advance of the enlisted men, it was possible to polish up their drill considerably before it was necessary for them to plunge into the work of the provisional companies. Much of great and enduring value in the way of discipline was implanted at the beginning by the senior instructor, by lecture and otherwise, and this was supplemented by drill and brief hikes. At this time the Sanitary Drill Regulations were in force, and the simple movements were taken up and dwelt upon at length. Thus in working up the first provisional companies and turning out from them the first overseas units, it was possible to build the new veterinary officers into the organization from the beginning. At the same time there were in the ranks graduate veterinarians who by their later work showed the value of their experience as privates in the ranks in these early days of the school's work. Throughout the first month, it was possible to bring the military efficiency of the veterinary officers along at the same rapid rate as the men, as officers actually in command, and without added instruction, for which indeed there was literally no time whatever. Later there were fresh arrivals from Camp Greenleaf who seemed not to have made so much out of their course there, and new officers from civil life who were utterly strangers to military drill and discipline. It was the rapidly growing proportion of these men that necessitated specialization of officers' schools.

That the proper emphasis might be placed upon the work, the veterinary instructors were required to attend the military classes and drill so far as such duty did not interfere with the purely veterinary work.⁴² The senior veterinary

instructor was insistent at all times upon the importance of the purely military side of the school and lent powerful aid to the senior instructor in military training. Thus the placing of his own assistants in the military classes by the senior veterinary instructor, until such time as they were excused through passing a satisfactory examination, was of the greatest value in bringing up the morale of those officers.

In the drill periods the form of instruction in use in the line officers' training camps was closely followed.⁴² For the purposes of the drill, the officers were all classed as privates. They were formed into two or more platoons, according to the total number available, and placed under the instruction of from 1 to 4 line officers under the general supervision of the senior instructor in military training.

At the same time evening classes were held, these including both study and lecture.⁴² The lectures were given by the line officers along the lines of the lectures they themselves had attended in their own training camps. There was persistent instruction in guard duty and drill, and there were lectures on courts-martial, Army paper work, Field Service Regulations, Army Regulations, and kindred necessary subjects. Emphasis was laid from time to time on those subjects in which the daily experience of the school showed the officers to be weak.

GAS INSTRUCTION

The first contingent of veterinary officers was well qualified to instruct in gas, when the officers' classes were formed; it was found advisable to put every officer through the course. This was done with the assistance for a time of officers from the Infantry School of Arms at Camp Lee.

ON THE MARCH

Practice marches, so vital a feature of Infantry instruction and training, were not authorized in the original synopsis of the schedule sent down from the Surgeon General's Office covering the military work of the proposed eight weeks' course, nor were they in effect in the course of training given to the first overseas units.⁴² In the course of this preparation, there seemed to be no need for them. The men responded so rapidly to the conditioning process of the existing schedule, the discipline was so satisfactory, and the time was so crowded that it is doubtful if practice marches would have improved these units to any appreciable extent, while they would undoubtedly have occupied much time that could have been and in fact was used to advantage otherwise. The only real road test was the short march to the first post of embarkation, and this was most satisfactory. When the personnel was kept so long awaiting orders for overseas after having been reported in readiness, it was deemed necessary for disciplinary purposes, as well as for the purpose of instruction, to take up practice marches. The men were in quarantine most of the time, and this quarantine was irksome in the extreme. It was felt to be a healthy plan to get them away from the camp from time to time, and it was felt, too, that road work, with carefully taught march discipline, was necessary to keep the men hardened, as well as to keep at top notch the esprit de corps which long close confinement to camp has a

well-known tendency to diminish. Therefore, after consultation with the commandant, the practice marches were instituted, at first by unit and then as a battalion.

These marches were held in conformity with the provisions laid down in Field Service Regulations, beginning with "hikes" that averaged about 4 miles, 2 miles out and 2 miles in; and were finally worked up to a "hike" of 15 miles, the entire day being spent in the field.⁴² The column consisted of 5 full hospital units of 300 men each, and the 2 smaller mobile units, totaling a little below 200. Thus the column was considerably larger than an Infantry battalion, albeit handled quite as easily. In the course of these marches the opportunity was seized to drive home the lessons of personal hygiene, care of equipment, and care of the feet. There were individual cases that provided concrete examples on which the unit commanders might enlarge in their lecture.

Coincident with these marches, other rapidly formed units were getting settled in camp contiguous to that of the Third Battalion.⁴² For purposes of administration, this personnel was denominated the Fourth Battalion, and was under command of the commander of the Third Battalion who was the senior instructor in military training. This Fourth Battalion was so occupied with its immediate intensive training that it did not participate in the road work, but was later taken out to the main drill field for battalion drill in the interests of mass instruction for both men and officers.

The road work was planned to be progressive.⁴² The pace was always easy, generally at a cadence of 112 to the minute. The battalion marched out of and into the school area at attention, and occasionally 20 minutes or so of the "hike" was conducted at attention and at a cadence of 120 to the minute. In order to occupy the minimum road space the ranks were closed to 40 inches, and file closers followed in the rear of the units. Unit commanders marched in front of their units, with the result that the column invariably presented a front of a single set of fours. It is believed that these practice marches were of the utmost value to both officers and men. Besides accustoming the men to the proper adjustment of equipment, the subordinate commanders were practiced in maintaining control of their men at the roadside halts, there was practical demonstration of the advantages of the sparing use of drinking water, the men were hardened appreciably as was evidenced by the rapidly decreasing number of fall-outs for any cause, and the morale of the whole battalion was appreciably improved. The column came in singing, and when dismissed the men went shouting to the bath, which was followed by careful foot inspection. Incidentally, the sick list was cut down materially.

Something of the competitive spirit was in evidence, as that unit which came in in the best order at the conclusion of a "hike" was designated to lead the column on the next succeeding "hike", and there was plenty of rivalry for the post of honor. Further to stimulate the interest of the men, new road formations were devised providing for columns of files at each side of the road, presumably to defeat aerial observation. Before the battalion left the camp these formations were rapidly and accurately made at the whistle signal. Thus the idea of marching at the "alerte" was implanted.

The longest "hike" was of 15 miles, $7\frac{1}{2}$ miles each way, to a farm on the Petersburg-Norfolk road, where the midday meal was eaten.⁴² On this "hike" one of the smaller units was used as an advance guard to further simulate war conditions. There was the added advantage of practice in the designation, prompt reporting, and use of the customary camp details for wood, water, kitchen, latrine, outguard, and other functions. Fortunately, the column left camp in a thick fog, which gave opportunity for testing connecting files and the customary means of communication from head to rear of the column. This day in the field was both valuable and enjoyable. The condition of the men was shown by the fact that there were only two stragglers, and these came in under their own power in charge of a noncommissioned officer only half an hour after the arrival of the rear of the column.

Much more of this work would have been attempted, and for longer periods, had it not been for insuperable obstacles arising from local conditions, notably the lack of proper transportation at Camp Lee for field ranges, etc., and a subsequent order forbidding units in overseas uniform appearing beyond the boundaries of the camp.⁴²

In the interests of a real test of the discipline of the Third Battalion, one night march was held under simulated war-time conditions.⁴² The route was 3 miles out and return on the road to Petersburg. From start to finish this march was conducted in silence, necessary commands being given by a pre-arranged code of hooded flashlamp signals. The men looked upon it as a "stunt" and were interested and enthusiastic. The most exacting march discipline was cheerfully maintained throughout.

It was deemed advisable from time to time to take the battalion out at short notice, thus accustoming both men and officers to promptness in reporting readiness to move. In the end the instruction staff felt that this sort of training was as valuable for troops of this character as for Infantry, and that it was especially noticeable in the effect on the morale at a time when completely equipped overseas units were chafing under strict quarantine awaiting orders to move for the port of embarkation.

Just at this time even the officers of overseas units were attending officers' drill, thus leaving the units for a part of the day in sole charge of their noncommissioned officers. This condition was seized upon for a further polishing of the latter. In order that their handling of the units at drill might be uniform throughout both the Third and Fourth Battalions, the noncommissioned officers were drilled as a company for an hour in the evening three times a week.⁴² They entered into the work in a hearty spirit of cooperation and carried the lessons learned back to their units with them. This special training would have been continued indefinitely but for the advent of the influenza epidemic. As it was, the work bore fruit, as it happened that on the day the commanding general made an inspection of the camp the units were drilling under their noncommissioned officers, while on another field the veterinary officers were drilling under command of the line officer instructors. The general expressed gratification at the work of the noncommissioned officers acting as company and platoon commanders, and was surprised to learn that they were practically all home-made products of the Veterinary School's training.⁴²

Another feature of the training was the drill by battalion, of the Third and Fourth Battalions. These organizations were broken up into battalions of convenient size for the rather restricted main drill field, providing four battalions in all. These battalion drills were supplemented by ceremonies which included the required inspections on Saturday mornings, and there followed week end after week end when the Third Battalion appeared in full strength, primed and fit for overseas orders. The influenza epidemic subsequently meant the breaking up and radical reorganization of the enlisted personnel of this Third Battalion, but there was a long period when it stood ready to move, thoroughly equipped and drilled and possessed of a morale that was gratifying in the extreme to its officers and instructors. Thus the battalion drill added to the schedule like the practice march may be said to have served a useful purpose.

VETERINARY HOSPITAL

A necessary part of the training of veterinary officers and men must be given in a practical manner. This was anticipated, and a modern veterinary hospital with adequate facilities for caring for the public animals of Camp Lee, including those of the auxiliary remount depot, was planned and authorized.⁴³ It was officially termed the "camp veterinary hospital," and originally was destined to become a part of the Veterinary Training School. Authorization of this part of the Veterinary Training School was made on March 22, 1918,³⁶ but construction of building was long delayed because of a labor shortage and the delay and difficulty in procuring building materials. In fact, construction of essential parts of the hospital buildings was not complete at the time the armistice was signed.⁴³ The following buildings were constructed:⁴³

Administration.—A standard type 5-room structure.

Officers' quarters.—Two 5-room buildings, each equipped with kitchen, pantry, dining room, and bath.

Enlisted men's barracks.—Two 2-story buildings of standard type, sufficiently large to house comfortably the 80 enlisted men of the command.

Mess hall for enlisted men.—Of standard type and large enough to accommodate 200 men.

Receiving and issue ward.—For the stabling of patients before their discharge or consignment to other wards for treatment. This ward had a capacity for standing 58 animals.

Medical ward.—Stalls for 100 animals, especially constructed stall for patients that are down, and a dispensary. In this, as in all other wards, there were installed electric lights and suitable provisions made for ventilation and drainage.

Surgical ward.—This ward was the largest and best-equipped ward of the hospital. It was built with the same kind of standings as the medical ward (concrete and cork-brick) and had the same facilities for the comfortable stabling of 100 animals. A connected operating unit was built and a well-lighted, steam-heated room for the handling of surgical cases was provided. This included an office for the ward surgeon and his sergeant, a dispensary and store-room, a sterilizing room, and a separate room for dressing wounds and for handling certain minor surgical cases. Connected with the operating unit was

a recovery stall for patients requiring special attention after having been anesthetized.

Contagious wards.—Three wards specially constructed for handling animals suffering from communicable diseases, each with stall room for 68 animals, formed a very essential part of the hospital.

Isolation ward.—One building capable of stabling 44 animals, built on the same plan as the contagious wards and located in the same vicinity. A double fence surrounded contagious and isolation wards in order to minimize the possibility of the communication of infectious diseases from animal to animal by direct contact. This same plan was utilized as a safeguard for contagious corrals located away from the wards.

Hospital stable.—For stabling animals used for hauling wagons and other necessary work at the hospital; also for stabling riding horses.

Forage barn.—A large building for storage of forage and so arranged that specially prepared feed could be supplied sick animals.

Hay shed.—For storing large quantities of hay and straw for animals treated at hospital.

Mortuary.—A well-constructed building for post-mortem examinations.

Yard offices.—For receiving and recording animals at the various wards. Also used for storing forage for daily use and apparatus such as gear, grooming, and feeding utensils.

Dipping vat.—For dipping animals in treatment of parasitic skin diseases. Not completed at time of the signing of the armistice.

Exercising ring.—Intended for a part of the work of conditioning patients before being discharged from the hospital. This also was not completed.

Septic tank and filtering bed.—For the sanitary disposal of sewage. The tank was completed in time for use, but the gravel bed was not put in operation.

ORGANIZATION

The hospital organization was effected with a twofold object in view—to give all necessary treatment to animals of the camp that required treatment and to train officers and men composing hospital units scheduled for overseas service.⁴³ Therefore, the personnel of the camp veterinary hospital was expected to manifest efficiency both as practical men in handling sick and injured animals and in giving practical instruction to those assigned to this hospital for training. It was intended that units in training at the Veterinary Training School would be sent to the camp veterinary hospital daily for instruction; such instruction to be of a practical nature. Officers were to receive instruction in practical administrative duties of a military character and also in the scientific work of conducting an army veterinary hospital. Noncommissioned officers in training were scheduled to work under the guidance of noncommissioned officers of the camp veterinary hospital. Likewise farriers, wagoners, and privates were to be taught, practically, all that was expected of them, to the end that they might become efficient in their respective duties before being sent overseas.

On February 15, 1919, all school records were transferred to the office of the personnel adjutant, Camp Lee, Va. The Veterinary Training School was closed formally at 5 p. m. February 15, 1919, and ceased to exist as an organization.⁴⁴

Source and distribution of personnel ⁴⁴

OFFICER PERSONNEL

	Line	Adjutant General's Department	Dental Corps	Medical Corps	Quartermaster Corps	Veterinary Corps	Total
Officers reported at Veterinary Training School	17	1	3	25	2	322	
Officers appointed from ranks						71	
Total	17	1	3	25	2	393	441
Officers assigned to veterinary hospital units sent overseas (includes 1 casual officer, Veterinary Corps)				16		187	203
Officers assigned to veterinary hospital units demobilized at Veterinary Training School, not having been sent overseas (includes 6 officers, Veterinary Corps, assigned to Veterinary Replacement Unit No. 5, on detached service, with transports, etc.)				1		64	65
Ordered elsewhere, other than overseas with units		1		3		11	15
Died						3	3
Discharged under provisions of sec. 9, Bulletin 32, War Department, 1917						1	1
Discharged for physical disability						1	1
Discharged per Circular 75, War Department, 1918	2		3	1	1	109	116
Remaining Jan. 15, 1919	15			4	1	17	37
Total	17	1	3	25	2	393	441

ENLISTED PERSONNEL

	Medical Corps	Quartermaster Corps	Veterinary Corps	Total
Total number of enlisted men reported at Veterinary Training School	218	4	7,968	8,190
Enlisted men assigned to veterinary hospital units sent overseas	176		6,076	6,252
Enlisted men assigned to veterinary hospital units demobilized and discharged at Veterinary Training School, not having been sent overseas	11		916	927
Enlisted men examined for commissions	134			
Number failed in examination	48			
Number passed examination	86			
Number awaiting appointment	15			
Number discharged per order to accept commissions, Veterinary Corps			71	71
Died:				
Provisional companies			32	32
Overseas units, while at Veterinary Training School			77	77
Ordered elsewhere (points other than overseas with veterinary units)		1	410	411
Discharged per Circular 77, War Department, 1918	1		19	20
Discharged for physical disability	2		19	21
Discharged at school	28	3	326	357
Assigned to duty, camp veterinary hospital, at close of school			22	22
Total	218	4	7,968	8,190

ENLISTED MEN WITH SPECIAL INSTRUCTION

Cooks, saddlers, horseshoers, and farriers transferred from Fort Riley, Kans.: Cooks, 24; farriers, 4; horseshoers, 42; saddler, 1.

Cooks were given special instruction at Cooks and Bakers School, Medical Officers' Training Camp, Fort Riley, Kans., and were given practical examination before being permitted to discontinue course of instruction.

The following number of enlisted specialists received instruction and were assigned to units at the Veterinary Training School: Cooks, 94; farriers, 744; horseshoers, 187; saddlers, 64.

Overseas units formed at school

Designation	Organ- ized 1918	De- parted 1918	Designation	Organ- ized 1918	De- parted 1918
Veterinary Hospital No. 7.....	July 6	July 25	Corps Mobile Veterinary Hospital No. 2.....	July 6	July 25
Veterinary Hospital No. 8.....	do.....	Do.	Corps Mobile Veterinary Hospital No. 3.....	Aug. 3	Oct. 27
Veterinary Hospital No. 9.....	do.....	Do.	Corps Mobile Veterinary Hospital No. 4.....	Sept. 7	do.....
Veterinary Hospital No. 10.....	do.....	Do.	Corps Mobile Veterinary Hospital No. 7.....	Nov. 2	Nov. 13
Veterinary Hospital No. 11.....	do.....	Do.	Corps Mobile Veterinary Hospital No. 8.....	do.....	do.....
Veterinary Hospital No. 12.....	Aug. 3	Oct. 13	Corps Mobile Veterinary Hospital No. 9.....	do.....	do.....
Veterinary Hospital No. 13.....	do.....	Oct. 16	Army Mobile Veterinary Hospital No. 1.....	do.....	July 25
Veterinary Hospital No. 14.....	do.....	Oct. 15	Army Mobile Veterinary Hospital No. 1-B.....	Sept. 7	Oct. 27
Veterinary Hospital No. 15.....	do.....	Oct. 27	Army Mobile Veterinary Hospital No. 2.....	Nov. 2	Nov. 13
Veterinary Hospital No. 16.....	do.....	Oct. 21	Base Veterinary Hospital No. 2.....	Aug. 3	Oct. 27
Veterinary Hospital No. 17.....	Sept. 6	Oct. 27			
Veterinary Hospital No. 18.....	do.....	Do.			
Veterinary Hospital No. 19.....	Sept. 7	Oct. 20			
Veterinary Hospital No. 20.....	do.....	Do.			
Veterinary Hospital No. 21.....	Sept. 6	Oct. 21			
Veterinary Hospital No. 25.....	Nov. 14	Nov. 23			
Veterinary Replacement Unit No. 1.....	Aug. 22	Oct. 13			
Veterinary Replacement Unit No. 2.....	Sept. 6	Do.			
Veterinary Replacement Unit No. 3.....	Sept. 7	Do.			
Veterinary Replacement Unit No. 4.....	Sept. 6	Do.			
Veterinary Replacement Unit No. 5 (returned to school Dec. 17; strength 34 officers, Veterinary Corps; 181 en- listed men, Veterinary Corps).....	Nov. 1	Nov. 17			

Units formed which did not depart

Designation	Organ- ized 1918	Remarks
Veterinary Hospital No. 22.....	Nov. 13	Enlisted men, colored.
Veterinary Hospital No. 23.....	do.....	Do.
Veterinary Hospital No. 24.....	do.....	Do.
Base Veterinary Hospital No. 3.....	Nov. 1	Colored.
Corps Mobile Veterinary Hospital No. 5.....	do.....	Do.

VETERINARY SCHOOL OF MEAT AND DAIRY HYGIENE, AND FORAGE INSPECTION, CHICAGO, ILL.

Prior to the Spanish-American War very little attention was devoted to the adequate veterinary examination of meats and dairy products for the military forces of the United States.⁴⁵ Subsequent to that period and very largely resulting from the experience gained during the Spanish-American War, a system of meat inspection was evolved which enjoined subsistence officers to familiarize themselves with meats, meat food and dairy products, and the various methods and practices involved in their preparation. This system included the employment of a limited number of qualified veterinarians at the important packing centers to supervise the preparation of meats, and courses of instruction occasionally were given by them to commissioned and noncommissioned officers of the subsistence department. Each of these courses covered a period of four to six weeks and the subject matter taught included principally the cuts and grades of fresh and cured meats. The practical and essential points concerning these products were reviewed in as thorough a manner as the limited time would permit.

The consolidation of the subsistence department into the Quartermaster Corps took many of the trained subsistence officers out of this special line of work and placed the responsibility of the inspection of meats very largely upon veterinarians who had been specially trained and had experience along these lines.⁴⁵

All recognized veterinary colleges in the United States at the beginning of the World War were conducting courses in meat and dairy hygiene, but few of the graduate veterinarians in 1917 were at all familiar with military requirements.⁴⁶ Up to that time little effort had been made to instruct the Army veterinarians along this very important branch of his profession, and there had been a lack of uniformity in the work accomplished.

As an emergency activity of the World War a school for veterinary personnel in meat-and-dairy hygiene and in forage inspection was found necessary. Chicago, Ill., was considered the most suitable place for the operation of a school of this kind, because the efficient training of veterinary officers and enlisted men in all the sanitary and procurement phases of military meat and dairy hygiene could be conducted there at the large depot where supplies were being purchased and handled in quantities in a huge packing house, products manufacturing, and dairy center.⁴⁶ Chicago was the most important procurement point for meat food supplies and forage; it assured access to the stockyards, large packing houses, products manufacturing concerns, dairy farms, public health laboratories, grain elevators, and hay warehouses, and insured a large number of students for instruction at one time, and these facilities were not available or obtainable elsewhere. Furthermore, at the Chicago supply depot all the advantages of direct contact with veterinary officers and enlisted men assigned inspection duty and who were actively engaged in making inspections were available. Therefore, in August, 1917, a school in military meat and dairy hygiene and in forage inspection for veterinary officers was established at the general quartermaster depot, Chicago, Ill., under the supervision of the depot veterinarian.⁴⁶

Later in 1917 a similar school for enlisted men was started at the same place.⁴⁶ Most of the enlisted men inducted for this service were exceptionally good packing-house men, well qualified and with considerable training in this particular line.

Selected veterinary officers were first detailed to this school in August, 1917, received intensive instruction until considered proficient, and then were detailed to organizations going overseas, and to divisional cantonments, stations, and procurement points in the United States.⁴⁶ Successive classes of officers and enlisted men were trained in this school for periods of from six weeks to three months until the formal authorization in July, 1920, of the Veterinary School of Meat and Dairy Hygiene and Forage Inspection.⁴⁷ The students were given individual, practical instruction in the packing houses and products establishments. This instruction was supplemented by daily lectures and conferences. From August, 1917, to November 11, 1918, 82 veterinary officers and 96 enlisted men completed instruction in this school.⁴⁶

The instruction given included lectures, practical work and demonstrations, and quizzes in the following:⁴⁶

Organization and administration of the veterinary meat and dairy hygiene and forage inspection service at points of procurement, at supply depots and at stations.

Sanitary inspection of establishments as to location, construction, equipment, and methods of operation.

Ante-mortem inspection of food animals, including marketing agencies, 28-hour law, transportation of food animals, their receipt at destination, market classes and grades of livestock, quarantine, and sanitary and procurement ante-mortem examinations.

Slaughter of food animals.

Post-mortem examination of food animals, disposition of diseased carcasses and parts, and denaturing rejected products.

General-products inspection; reinspections; authorized ingredients; branding; laboratory examinations; miscellaneous products as gelatin, mincemeat, beef extract, bouillon cubes, rabbits; and the sanitation of inedible compartments in official establishments manufacturing neat's-foot oil, glue, tallow, greases, tankage, and fertilizer.

Fresh beef, veal, mutton, and pork.—Offal, carcass meat, wholesale cuts and trimmings as to sanitary source; selection; classes, grades; grading for condition, quality, and weight; dressing; branding; chilling; trimming; boning; freezing; defrosting; covering; packing; stamping of packages; handling; storage; shipment; receipt; issue; veterinary, sanitary, and procurement examinations; reinspections; action; manufacture of ice.

Cured pork and beef products, considering especially Army bacon, hams, shoulders, salt pork, corned beef, dried beef, salt beef, ox tongue, meat flour, tripe, and other cured products as to veterinary, sanitary, and procurement examinations; sanitary source of products; selection; grading for condition, quality, trim, and weight; cutting; trimming; grading for cure; authorized curing ingredients; pumping, placing into cure, overhauling, manufacture of curing mixtures or solutions; brushing; washing; labeling; hanging; smoking; weighing; wrapping; packing; stamping of packages; handling; storage; shipment; receipt; issue; sanitary and procurement requirements; reinspections and action.

Canned meats, including roast, corned, and dried beef; corned beef hash; ox tongue; meat flour; Army bacon; pork for beans; fresh pork sausage; Vienna style sausage; veal loaf and other canned products as to sanitary source; soundness of ingredients used, cutting, boning, soaking, curing, pickling, cooking, trimming and sorting of meats; cans, their construction, size, cleanliness, stuffing, weighing, sealing, exhaustion and sterilization; examination of finished canned products as to defects of manufacturing, lacquering and labeling; weighing; packing; development; handling; storage; shipment; receipt; issue; sanitary and procurement requirements; reinspections and action.

Rendered meat products, considering oleo stock; oleo stearine; oleo oil; edible tallow; prime steam, refined, neutral, kettle rendered, dry rendered and hydrogenated lards; lard compound; margarines and lard substitutes, as to sanitary source; authorized ingredients, including selection, soundness, grading for condition, quality and quantity; the washing, trimming, handling, chilling, hashing and rendering of fats; the settling, drawing off, clarification, bleaching, filtering, cooling, seeding and pressing of oils; manufacture and Pasteurization of starter; weighing, mixing, and churning ingredients; crystallization; tempering; working; blending; packing; crimping; weighing; strapping; branding;

handling; storage; shipment; receipt; issue; laboratory examinations; sanitary and procurement requirements; reinspections and action.

Sausages, including fresh, smoked, cooked and dry sausages, cooked meats, pork products customarily eaten without cooking and other sausage-room products, considering ingredients used, as casings, meats, spices, preservatives, cereals, water and dyes; their sanitary source, selection, preparation, grading for condition, quality and amount, their curing, freezing, defrosting, grinding, trimming, chopping, boning, mixing, stuffing, or other preparation; wrapping; smoking; cooking; chilling; washing; drying; branding; handling; weighing; storage; shipment; receipt; issue; laboratory examinations; sanitary and procurement requirements; reinspections and action.

Poultry, live, fresh dressed, frozen, and canned; including their sanitary source; classes; shipment; fattening; ante-mortem and post-mortem examination; slaughter; plucking; chilling; weighing; grading; drawing; packing; freezing; storage; defrosting; canning; handling; receipt; issue; sanitary and procurement requirements; reinspections and action.

Eggs, including fresh, sterilized-shell-processed, frozen, desiccated and preserved eggs, as to structure, production, characteristics, candling, classes, grades, handling, packing, storage, shipment, receipt, issue, sanitary and procurement requirements, reinspection, and action.

Marine products, including fresh, frozen, cured, and canned salmon, sardines, codfish, mackerel, anchovies, caviar, herring, tuna, fish flakes, crab meat, clams, oysters, lobsters, halibut, shrimp, and other fish and sea foods, as to sanitary source; acquirement; handling; dressing; chilling; packing; shipment; storage; freezing; defrosting; curing; canning or other preparation; receipt; issue; sanitary and procurement requirements; reinspections and action.

Milk, including fresh, whole milk, skim milk, cream, whipping cream, certified milk, inspected milk, Pasteurized milk and cream, condensed milk and cream, powdered milk, reconstructed milk, malted milk, and ice cream, as to standards, composition, adulterations, laboratory examinations, production, sanitary dairy farm examination, tuberculin testing of dairy animals, sanitary inspections of collecting depots, creameries, and Pasteurizing plants; ingredients, processes of manufacture, classes, grades, handling, packing, storage, shipment, receipt, issue, sanitary and procurement requirements and action. Some of this instruction was carried on under arrangements made with the health department laboratories of the city of Chicago.

Butter, including sanitary source; selection, sampling, testing, grading, standards, and adulterations of ingredients used; the receipt, weighing, grading, mixing, heating, ripening, and churning milk or cream; the salting, washing, working, testing, weighing, canning, scoring, wrapping, packing, labeling, storage, handling, shipment, receipt, issue, laboratory examinations, sanitary and procurement requirements; reinspections and action.

Cheese, including American Cheddar type, pimento, Camembert, Swiss, Edam, canned and other cheese, as to sanitary source, methods of manufacture, classes, grades, scoring, standards, adulterations, selection, handling, storage, shipment, receipt, issue, sanitary and procurement requirements; reinspections and action.

In addition to the above training, in February, 1918, a special class of five veterinary officers was organized under two experienced veterinary officers who were specialists in the manufacture and inspection of butter.⁴⁶ These five officers were intensively trained in this work so that in May and June of that year they supervised the manufacture and canning of more than 1,000,000 pounds of creamery butter. This class rendered additional valuable service on butter inspection. In September, 1918, when the Army commandeered 80 per cent of the butter in the United States in cold storage, these veterinary officers selected, graded, weighed, inspected, and certified for payment 6,217,897 pounds of butter and more than 3,000,000 pounds of cheese, valued at more than \$3,781,000.⁴⁶

The importance of the training of veterinary personnel in meat and dairy hygiene is shown by the inspections maintained by the Veterinary Corps from April, 1917, to March 31, 1919, as follows: At purchasing points, 1,261,728,441 pounds of meats and dairy products, having a money value of \$473,914,827.62, were inspected and passed for food; at stations, 234,153,619 pounds; for the Italian Government, 976,687 pounds of fresh, frozen beef; and for civilian relief work in Europe, inspected and supervised the packing and shipment of 31,454,566 pounds of meat. In addition, 10,956,408 pounds were rejected, making a grand total of over one and one-half billion pounds of meats and dairy products inspected by trained Army veterinary personnel during this period.⁴⁶

VETERINARY LABORATORY, PHILADELPHIA, PA.

A veterinary laboratory was established at Philadelphia, Pa., in January, 1918, with a major, Veterinary Corps, in charge.⁴⁸ Laboratory rooms were loaned by the University of Pennsylvania, and equipment and supplies were furnished by the Medical Department. The main purpose of the laboratory was to conduct research in the etiology, prevention, and treatment of equine influenza, pneumonia, and strangles. With a view of supplying veterinary laboratory service at all the department laboratories, several officers of the Veterinary Reserve Corps, specialists in laboratory procedures, were ordered to active duty at the Philadelphia laboratory for about six week's intensive instruction in uniform technique. At the completion of this course these students were assigned to department laboratories.

The research problems studied included experiments with the intradermic mallein test and its effect upon subsequent serological tests for glanders, with various veterinary biological products, the value of acetic acid in the treatment of *B. necrophorus* infections, and the development of a bacterin for use in the control of equine infectious abortion.⁴⁹

ARMY SCHOOL OF NURSING *

The recommendation of the Surgeon General for the establishment of an Army school of nursing as the method of providing for the rapid expansion of skilled nursing service that the continuation of the war would inevitably demand was approved by the Secretary of War, May 25, 1918.⁵⁰

* Unless otherwise indicated, this report is based on "The History of the Army School of Nursing," by Annie W. Goodrich, Army School of Nursing. On file, Historical Division, S. G. O.

As a result of a conference in the Surgeon General's Office, the chairman of the Red Cross nursing service, the superintendent of the Army Nurse Corps, and the chief inspecting nurse were appointed a committee to prepare a plan for the suggested school. The committee, after consultation with the nurse members of the committee on nursing of the Council of National Defense, reported as follows:⁵¹

1. The committee appointed by your order has interpreted its purpose to be:

The creation of a plan whereby through an Army school of nursing the most complete nursing care may be provided for the sick and wounded soldiers at home and abroad, for the period of the war and for as long thereafter as the Government may decree. Also nurses for such other health fields as may be developed by the Medical Department.

The plan to provide for an easy, constant, and almost unlimited expansion of training fields and consequent increase in student and graduate nurses, in order that the arising demands of the service be fully met.

Through the provision of the student body to have in the process of training large groups becoming increasingly competent, thereby enabling the release of the most experienced nurses for the foreign and other demanding fields without lowering the efficiency of the base hospitals.

To immediately raise the standard of the nursing care of the sick in the base hospitals by the provisions of an increased number of persons to render such care.

2. The plan as presented provides that the school, to be known as the Army School of Nursing, shall be located in the Office of the Surgeon General. Through this office the enrollment of the students will take place, and all matters relating to the general management of the school shall be dealt with. The faculty, presided over by the dean of the school, is to determine all questions relating to the course of instruction, the general administration of the school being intrusted to the dean. It is suggested that an advisory council be appointed composed of members of the Medical Department, the superintendent of the Army and Navy Nurse Corps, the director of the department of nursing of the American Red Cross, the presidents of the American Nursing Association, the National League of Nursing Education, the National Organization for Public Health Nursing, the dean of the School of Nursing, and other members of the nursing profession conversant with the problems of nursing education to make recommendations concerning the appointment of the faculty, the relations between the military and civil hospitals, and other matters relating to the general policy of the schools.

The course of training will be given in the various base hospitals assigned as training camps, each one of which will be a complete unit, having its own director, its staff of lecturers, instructors, and supervisors, and its teaching equipment. These units will be developed as rapidly as the needs of the service demand. The directors and such members of the teaching staff as shall later be determined shall be members of the faculty.

The course leading to a diploma in nursing shall extend over a period of three years. The experience in the military hospital will provide surgical nursing, including orthopedic, eye and ear, and nose and throat; medical, including communicable diseases and nervous and mental diseases. Experience in children's diseases, obstetrics, and public health nursing will be provided through affiliation.

It is believed that the complete course will attract the most intelligent and largest number of women to the school and will result in a more efficient service both in the military hospitals and in such public health fields as the Medical Department may assign nurses to.

Upon completion of the course the students would become members of the Regular Army Nurse Corps in the order of the vacancies; or should there be no vacancies, they would be placed on the list for appointment as vacancies occur.

They would be eligible for State registration, for membership in the American Nurses' Association, the national organization for public health nursing, enrollment in the nursing service of the American Red Cross, and for advanced courses in the teaching, administrative, and public health fields.

A detailed outline of the plan is herewith presented, together with recommendations concerning the necessary circular and forms that will enable the immediate development of such a school if the authorization for its establishment is granted.

ORGANIZATION

The authorization of the establishment of the school brought into immediate existence a division in the Surgeon General's Office designated as the Army School of Nursing, and administered by the chief inspecting nurse, under the title of dean, who was directly responsible to the hospital division. The work fell into three bureaus: General information, credentials, and inspection, with a professional personnel of 9 and a maximum clerical staff of 30.

Bureau of general information.—This bureau was flooded with inquiries following a brief announcement of the school in the Official Bulletin, and an excellent and widely disseminated article in the press. Through the committee on nursing of the Council of National Defense, 25,000 announcements of this school were issued by a private printing company within a week, and the small printing department at Walter Reed Hospital put out 10,000 each of the various forms required by the applicant for admission within a few days, thereby making possible a rapid enrollment of students.

Bureau of credentials.—The requirement of four years' secondary work, or an educational equivalent, for admission to the school, and the giving of credits for advanced work, demanded careful and accurate evaluation of credentials.

Bureau of inspection.—This bureau was charged with the standardization of nursing care and equipment for the military hospitals where students were to be placed, the maintenance of the educational standards of the school, and the reports on civil hospitals and other institutions in connection with student affiliation.

Pending the decision as to the creation of a school, the inspection of the base hospitals was continued. At this time 20 inspections had been made, each one strengthening the opinion that the school would not only prove the most effectual supplement of the graduate nurse staff, but would be an important factor in raising the standard of nursing care.

One hundred and twenty-six inspections and visits were made in this country during the year, the signing of the armistice, with a consequent rapid decrease in the nursing service, obviating the necessity of the inspection of the military hospitals overseas, originally included in the functions of this bureau.

The advisory council.—In accordance with the plan of the school, the Surgeon General appointed an advisory council, on which sat five medical officers representing the Medical Department of the Army; representing the nursing profession were the chairman of the committee on nursing, the chairman of the Red Cross nursing service, the president of the American Nurses Association, the president of the National League of Nursing Education, the honorary president of the National Organization of Public Health Nursing, the superintendent of the Navy Nurse Corps, the superintendent of the Army Nurse Corps, the superintendent of the Presbyterian Hospital Training School, and the dean of the Army School of Nursing. Two meetings of the council were held during the year. At the second, in February, 1919, a resolution recommend-

ing the creation of a permanent school by Congress was passed and referred for approval to the Surgeon General, together with a tentative draft of a bill incorporating the essential requirements for the establishment of a school of high standards and on a sound basis.

Faculty.—The faculty comprised nurse directors and instructors, medical lecturers, and such other assistants as were required in the development of the school at the various military hospitals where students were placed.

Three conferences of the nurse members of the faculty were authorized by the Surgeon General, the last—of special value—being called in Chicago, in conjunction with the convention of the National League of Nursing Education, thereby making possible a discussion of nursing problems affecting both the civil and military schools, and strengthening the cooperation between the two.

The first literature concerning the school was issued on June 7, 1918; on June 17, 75 applications had been filed. Applications continued to come in in increasing numbers, the maximum received in one week being 1,249, and by November 11, the date of the signing of the armistice, 10,689 had been received, of which 5,267 had been accepted, 3,185 declined, and 2,219 were still under consideration; 1,099 students were on duty in 25 military hospitals, and 567 students were ready for assignment immediately upon the withdrawal, for overseas duty, of a sufficient number of graduate nurses to provide the necessary accommodations. For a brief period following the signing of the armistice, the acceptance and assignment of students continued, bringing the accepted applications up to 5,869 and the number of students on duty to 1,578, in 32 military hospitals, on December 21, 1918.

United States Student Nurses Reserve.—From the outset the Red Cross divisions rendered active assistance in recruiting students for the Army School of Nursing, but the heavy enrollment of graduate nurses that the continuation of the war would inevitably necessitate and the importance of a largely increased student body in both civil and military hospitals, in order that the release of the graduates be effected, without imperiling the sick in this country, made imperative a definite and extensive recruiting campaign. Such a campaign was undertaken by the women's committee of the Council of National Defense, cooperating with the Surgeon General of the United States Army, the American Red Cross, and the nursing committee of the council, under the title of the United States Student Nurses Reserve. The program provided for an intensive campaign, extending from July 29 to August 11, for the enrollment of 25,000 young women pledged to hold themselves in readiness until April 1, 1919, to enter either a civilian school of nursing or the Army school, if called, with the privilege of expressing a preference as to the school. Only students meeting the age and educational requirements, however, were placed on the waiting list of the Army school. As the full quota desired was not realized within the period of time allotted, the various State committees were authorized to continue the enrollment until the need ceased.

College preliminary course.—A further and not less important plan was developed by the American Council on Education, with the approval of the Surgeon General, whereby intensive preliminary courses of 12 weeks were to be established at higher educational institutions, the American Council on

Education undertaking to assist in recruiting students. The estimated quota was 2,000 students by October 1, 1918; 4,000 by January, 1919; and 5,000 by April, 1919. A number of colleges had signified their readiness to give these courses, while others had the matter under favorable consideration, when the cessation of hostilities led to its abandonment. This group would have been a valuable addition to the student body, relieving the Army school of the three months' preliminary course and making the student of immediate assistance in the hospital ward.

Civil school students.—As a means of further increasing the nursing personnel through a student body, and to steady the situation in the civil hospitals by giving their students a place in the war program, an opportunity was opened in August, 1918, to the schools of the 50 Red Cross base hospitals first sent overseas to send such a number of their senior students as could be spared, through affiliation with the Army School of Nursing, for immediate service overseas.

A course in the military hospitals of four months was also arranged for the senior and intermediate students of other civil schools, through which, if adjusted satisfactorily, they would be prepared for overseas service immediately upon graduation, or could be sent earlier, if necessary; it being desired that the students in the Army School of Nursing should have been in the service, if possible, a year before being sent overseas. Information and regulations relating to the course had been issued, and a number of civil schools had signified their desire to send students, when hostilities ceased.

Hospital assistants.—In order to conserve all available material it was also decided to enroll as hospital assistants women disqualified for overseas service by marriage or overage, and therefore not eligible for enrollment as students in the Army School of Nursing or in the civil schools. It was believed that this group, of whom approximately 1,000 had applied, would well supplement the graduate nurses in the convalescent hospitals in this country, leaving the acute service for the student body. To avoid complications and confusion relating to eligibility and placement and to insure an increasing competency of service through instruction and supervision, this group was entered as a division of the Army School of Nursing.

Red Cross aides.—The increasing shortage of nurses overseas, and the constant pressure for aides, due presumably to the failure of those in charge on the other side to understand both the potentialities of the school and that the shortage related to transportation rather than to an exhausted or inadequate graduate nurse supply, together with the anxiety caused by the influenza epidemic, led to the suggestion of the enrollment of practical nurses as less likely to affect the enrollment in the school, and to a countersuggestion calling for the enrollment of Red Cross aides:

I recommend against the enrollment of the practical and experienced nurses because they represent a class now more needed than ever in community life, because of the withdrawal of graduates * * *.

Rather than call upon the practical nurses so-called, I recommend:

1. Pushing the Army School of Nursing, which is the strongest part of our program.
2. Calling upon the civil hospitals to send affiliating pupils as many have indicated their desire to do.

3. Calling upon the civil hospitals to give preliminary training to hospital assistants, the group already authorized. This group to include married women between 21 and 40 whose husbands are overseas and single women between 35 and 45. This will establish the machinery for training a larger group should necessity arise. This course to cover six weeks or two months.

4. In order to meet the present emergency requirements, I recommend that the Red Cross select with care 1,500 of their nurses' aides who are between 35 and 45 years of age, and that these be sent at once overseas to supplement the nurses over there. This will meet the emergency and leave the field open here for the development of our program for the Army school and hospital assistants.

5. That an appeal be issued at once in the name of the Surgeon General to all young women of the country calling them to service, either through enrollment in the Army school or civil schools or as hospital assistants, according to the group in which they fall, and making plain to them that this is their greatest service, and also emphasizing that the pupils will be sent overseas as soon as ready and as needed.

Accordingly, the Surgeon General requested the American Red Cross nursing service to enroll 1,500 nurses' aides.

At the request of the Red Cross the age limit of the 1,500 aides was reduced to 30, it having been ascertained that only about 7 per cent of the accepted applicants for admission to the Army school exceeded that age. The signing of the armistice prevented the sending of these aides overseas.

The development of the training school units.—The rapid development of the school, obviously so necessary, and made possible by the immediate and heavy enrollment of students, was greatly delayed and hampered by the unfamiliarity of the chief nurses with the training school field, the large number of executives and instructors that had been sent overseas, and the consequent shortage of such personnel in the civil schools. A further difficulty came through failure to provide a graded service for the Nurse Corps, analogous to the grading of the commissioned personnel, and an almost universal system of control and direction in civil institutions; this omission made the positions of head nurse, supervisor, night superintendent, etc., undesirable, since they entailed increased responsibility without increased authority or salary; the omission to furnish the chief nurses with any data, other than the meager efficiency records, relating to the general education and the professional preparation of the graduate nurse personnel and the branches of nursing in which they had had experience was a still further handicap in the selection of an efficient supervising staff. The greatest obstacle in the school development was due, however, to the slow transportation of graduate nurses overseas and consequent inadequate housing capacity.

This delay was overcome in a measure by a circular letter, informing the commanding officers that in the future students would replace the graduates sent overseas, and ordering that quarters be found as soon as possible, as it was imperative that the course be begun and the efficiency of the students thereby hastened.

Chief nurses released for overseas duty were replaced by those who held executive positions in civilian schools, while the release was sought and obtained of several well-known nurse educators.

Thus an adequate number of executives were obtained, and, in the majority of cases, instructors of pedagogical as well as professional preparation were

secured. A notable contribution was the privilege of the four months' preliminary course at Teachers' College, Columbia University, New York City, for the training school unit at United States Army General Hospital No. 1, made possible by the authorities of the college through the omission of all tuition fees for these students.

COURSE OF STUDY

The timely issuance of the standard curriculum, prepared by the education committee of the National League for Nursing Education, made possible a uniform course of instruction. The necessary text and reference books and a classroom equipment, excelling that of most schools, were authorized, and despite the delays consequent upon a war situation were, in the main, promptly delivered.

The time allotted to the various subjects was divided between lectures and demonstrations by members of the medical staff or special lectures, and classes, quizzes, and laboratory work under qualified nurses and other instructors.

The subjects included in the preliminary course were: Anatomy and physiology; applied chemistry; bacteriology; personal hygiene; hospital house-keeping; nutrition and cookery; drugs and solutions; elementary nursing principles and methods; bandaging; historical, ethical, and social basis of nursing.

The subjects following the preliminary course included: *Materia medica* and therapeutics; diet in disease; massage; surgery; orthopedics; diseases of the eye, ear, nose, and throat; operating room technique; general medicine; communicable diseases; occupational, venereal, and skin diseases; nervous and mental diseases; diseases of infants and children; gynecology; obstetrics.

Public health nursing, social service, and other subjects relating to the problems of the several fields of nursing and modern social conditions will be taken up in the third year.

STUDENT NURSES

When the proposition for establishing an Army school of nursing and training students in our camp hospitals was first launched, a general impression prevailed that this would be a dangerous undertaking from the social standpoint. A large number of young and recent graduates had been obliged to face the unusual conditions of camp life with perhaps less preparation for meeting such conditions than many of the students enrolled in the Army school who had previously been thrown on their own resources, or who had passed through college, or had been in the teaching field. Therefore, it was felt that with proper guidance from the directors, instructors, and social directors of the units, the students would not be at any less disadvantage than those in our civil schools. The students were quick to adopt a plan of self-government under the advice of their director and instructor and assumed the responsibility in maintaining the good standing of their individual groups. It was interesting to see how this worked out in the various units and the problem of their social life brought under their own control. (See *infra*, p. 452.) The social activities showed a variety of features. In some, music was dominant, in others the drama; glee clubs were organized, playlets written and carried out; in some groups drill and outdoor sports were emphasized. Students in all of the units were drilled

every day, or at least three times a week, out of doors when the weather was good; if not, indoors with open windows in the form of setting-up exercises. In an interesting group of 100 in one of our northern camps, students were outfitted from the Quartermaster Department with leggings, coat, and over-seas cap for outdoor drill and hikes.

These wholesome forms of exercise and recreation created a splendid unit and took care of the leisure time after study and ward duty; when brought under the control of the student body itself it promoted a strong class spirit and unity. The Red Cross recreation house, designed for the uses of the nurses of the Army Nurse Corps, was, as a rule, given over to the students on one or two evenings of the week that they might receive their visitors, have dances, or other form of entertainment as they arranged for.

UNIFORM

A military uniform and insignia were authorized by The Adjutant General, the latter being a bronze lamp, superimposed on the Caduceus, a tribute to the founder of nurse training schools, Florence Nightingale.

STATE REGULATIONS OF THE SCHOOLS

The educational requirement for admission and the period of professional education entitled the graduates of the school to nurse registration, except that students to whom credit for collegiate or technical work was given were not eligible in States requiring a full three years' course in a hospital.

CONTINUATION OF THE COURSE

The close of the fiscal year (June 30, 1919) presented 741 students remaining to complete the course, leading to the diploma of the school, 573 on duty in 15 military hospitals, and 168 absent in the affiliating schools. The percentage of withdrawals was not high considering the large number of students previously engaged in the occupational fields.

AFFILIATION WITH CIVIL SCHOOLS OF NURSING

The response of the civil hospitals to the request for experience in the services not obtainable in the military hospitals was generous both as to opportunity and in the adjustment required to meet the needs of the Army school; affiliation being effected with the leading hospitals able to give the required experience in New York, Baltimore, Philadelphia, St. Louis, Washington, Chicago, Boston, Minneapolis, Cincinnati, Newton, Mass., and San Francisco.

The credit allowed for advanced work reducing the term in the school and the admittance of the entire body of students within a period of six months necessitated, in order that the full experience be obtained by each student seeking a diploma, an earlier admission to the affiliating courses than is customary for the special hospitals (maternity especially) to permit. These requirements were relaxed, but the adjustment of the students to the work was satisfactory and is evidence of the value the student body would have been for overseas duty had the war continued.

ARMY SCHOOL OF NURSING, UNITED STATES ARMY BASE HOSPITAL, CAMP GRANT, ILL.

The report of the Army School of Nursing conducted at the base hospital, Camp Grant,⁵² is given in full as an illustration of the conduct of an Army school:

STUDENT NURSE BATTALION, ARMY SCHOOL OF NURSING

In the spring of 1918, it was apparent that there would be an acute shortage of graduate nurses in the Army. The civilian communities had been combed of available qualified graduate nurses and still there was an urgent call for graduate nurses from overseas.

The division surgeon, 86th Division, Camp Grant, and the commanding officer, base hospital, Camp Grant, Ill., made a recommendation to the Surgeon General of the Army, under date of June 8, 1918, that this hospital be permitted to conduct a school for practical nurses in order that graduate nurses be released for overseas duty. In reply to this communication, the Surgeon General stated that his office had under consideration a proposed plan for conducting training schools for nurses in the Army that would require three years for graduation. This plan was superior to the one offered from Camp Grant in that the nurse would be a graduate and thoroughly qualified to carry on this profession as her life's work. This same communication stated that if the Army School of Nursing was organized, Camp Grant would be one of the camps selected.

The first group of students arrived August 14, 1918. They were typical "rookies," dressed in every conceivable costume and very much excited over their new environment. They expected and were willing to live in barracks and undergo many of the hardships that are ordinarily experienced in field service. Attractive quarters had been built and furnished for the students. The faculty was organized for their training, both from a professional and military standpoint, and the students were assigned to duty the following day.

The problem of discipline was one that we had given considerable thought, and it seemed advisable to give the new rookies some of the military training that is customary for all recruits; therefore, drill was promptly started and the girls were given the same foot drill as is given enlisted men of the Medical Department. They were intelligent and grasped the idea rapidly. However, there were two features that were difficult to overcome and are not ordinarily encountered in drilling enlisted men. One was looking around and laughing, while the other was an uncontrollable desire to be continually fixing their hair. This group was called Company A and was turned out daily for retreat.

The second group of students arrived September 18, 1918. There were 36 in number. This group was organized as Company B and given the same instructions as Company A. They were much easier to train, as Company A assisted very materially in the training. Authority was obtained to issue olive-drab overcoats. This was promptly done and has served a good purpose. Not only has it been a material saving to the students, but adds much to the military appearance. Company B arrived but a short time before the "flu" epidemic. In fact, they were here but a few days before it was necessary to put them into the wards, and the undersigned desires to go on record as saying that the students of both Company A and Company B were of the greatest value during that emergency.

The third group of students arrived November 20, 1918, and were organized as Company C. Students were selected from the three groups as commissioned and noncommissioned officers. A captain, first lieutenant, second lieutenant, first sergeant, and necessary sergeants and corporals were properly uniformed and assigned to each company. The students were given squad, company, battalion, and athletic drill and were outfitted in a woolen uniform, with puttees and overseas cap, on account of the severe winters in this climate. Daily drill and retreat was kept up until the early spring. The students were greatly benefited by the drill, as was noticed in the manner in which they would receive and obey orders, and the military manner in which they would carry themselves. It is an inspiring sight to see the manner in which they honor the flag at all ceremonies.

REPORT OF THE ARMY SCHOOL OF NURSING AS INCORPORATED IN THE QUARTERLY REPORTS,
ARMY NURSE CORPS, SUBMITTED TO THE COMMANDING OFFICER BY THE CHIEF NURSE,
UNITED STATES ARMY BASE HOSPITAL, CAMP GRANT, ILL.

July 1 to Sept. 30, 1918:

Admitted by appointment—

Aug. 15, 1918..... 34

Sept. 15, 1918..... 36

Discharged—Physically disqualified for service..... 1

Total days sick report to Sept. 22, inclusive..... 9

Total days sick report from Sept. 23 to Sept. 30, inclusive..... 62

Total number of students Sept. 30, 1918..... 69

Oct. 1, 1918, to Dec. 31, 1918:

Students on duty Oct. 1, 1918..... 69

Admitted by appointment Nov. 22, 1918..... 40

Discharged—Physically disqualified for service..... 1

Resigned..... 8

Deaths..... 1

General average of students on duty..... 79.42

Total days sick report..... 409

Average daily sick..... 4.4

Students on duty Jan. 1, 1919..... 99

Jan. 1, 1919, to Mar. 31, 1919:

Students on duty Jan. 1, 1919..... 99

Admitted by appointment..... 0

Admitted by transfer—

Feb. 9, 1919, from Fort Riley, Kans..... 1

Mar. 13, 1919, from Fort Riley, Kans..... 12

Mar. 25, 1919, from Camp Sheridan, Ala..... 17

Discharged—

Physically disqualified for service..... 7

Professionally disqualified..... 2

Resigned..... 5

Deaths..... 2

General average of students on duty..... 91.9

Total days sick report..... 434

Average daily sick..... 4.8

Students on duty Apr. 1, 1919..... 113

Apr. 1, 1919, to June 30, 1919:

Students on duty Apr. 1, 1919..... 113

Admitted by appointment..... 0

Admitted by transfer..... 1

Transferred to other stations..... 79

Discharged—

Physically disqualified for service..... 5

Professionally disqualified..... 4

Resigned..... 23

General average of students on duty..... 77.3

Total days sick report..... 377

Average daily sick..... 4.1

Students on duty July 1, 1919..... 3

Survey of student nurses on duty at United States Army Base Hospital, Camp Grant, Ill., from August 15, 1919, to June 21, 1919

Date	Admissions	Discharges	Transfers		Deaths
			Gains	Losses	
August, 1918.....	34	1			
September, 1918.....	36				
October, 1918.....		1			1
November, 1918.....	35	6			
December, 1918.....	5	2			
January, 1919.....		7			1
February, 1919.....		1	1		
March, 1919.....		6	29		1
April, 1919.....		13		7	
May, 1919.....		16	1	23	
June, 1919.....		3		49	
Total.....	110	56	31	79	3

THE WORK OF THE STUDENT NURSES DURING THE EPIDEMIC

Sunday, September 22, 1918, the first cases of Spanish influenza were brought into the base hospital and on the afternoon of that day the students met in the sewing room and there inspected and remade hundreds of gauze masks to make them comply with requirements. When this work was completed the girls of the second group went to the demonstration room in the school building and there were given a demonstration lesson in bed making.

Monday morning the girls of the second class, or, as they are called, the second group, were called out to make beds and help put barracks in readiness for the receiving of sick soldiers.

These barracks had been used as quarters for men of the Medical Corps and had to be cleaned and filled with supplies suitable for the maintenance of a ward. Groups of men were detailed who swept and scrubbed the floors, cleaned windows, unpacked beds and chairs, carried them into the wards, and did such other work as was required of them. The student nurses scrubbed and made up the beds, helping arrange them in regular rows, cleaned and arranged linen closets, cleaned the kitchens, washed dishes and silverware; in fact, doing the necessary work called for to make the buildings ready for the use of the sick boys.

This work of opening up barracks continued for a week, during which time 18 or 20 soldiers' barracks, each having an average capacity of almost 100 men, were opened for ward purposes and beds made up in the corridors of the base hospital. Many of the beds made were equipped with straw ticks and the making of such beds was an entirely new effort on the part of many of the girls. After the beds were made and arranged as they should be, sputum cups, folded napkins, paper bags for refuse, towels, a bathrobe, slippers, and a pajama suit were placed on each bed.

Influenza made its entrance into the ranks of the nurses during the first week and, being no respecter of classes, attacked many of the graduate nurses as well as the girls of the training school. The infirmary was soon taxed to its capacity; and, as there was no place fixed for the sick nurses, many were left in their rooms and placed under the care of the nurses of the infirmary. Finally the number of ill nurses in the quarters increased to such a number that it was impossible for one nurse to care for them, in addition to her patients in the infirmary, so students of the training school were appointed to look after the sick nurses in the quarters. These were required to take care of the diets of nurses who were ill, take pulse and temperature, and daily give a report of each sick nurse to the graduate nurse who had charge of the infirmary; they were allowed, also, to give aspirin tablets and magnesium sulphate under the direction of the graduate nurse.

The number of nurses suffering from influenza increased so rapidly that a second infirmary was opened in the school building and nurses who were confined to their quarters were moved to this place. Here student nurses were given some practical ward work.

The number of patients in the wards increased so rapidly and the nurses and corps men were so rushed with work that it became necessary to organize cleaning squads, or, as they

were called, "broom squads," to aid in the cleaning of wards. There were eight of these squads, each composed of 8 men who worked 8 hours daily under the supervision of a student nurse. These broom squads were each assigned to certain groups of wards, and it was their duty to see that the wards were cleaned of all refuse each morning and everything was in good order.

During the second week of the epidemic some of the students were put on ward work and there received their first lessons in practical nursing; and though this work was difficult for an inexperienced girl, each one did her part cheerfully, grateful for the opportunity of contributing her mite toward checking the epidemic.

STUDENT GOVERNMENT

On Saturday, August 17, 1918, Miss Anne Williamson, director of the Army School of Nursing, Camp Grant, in her opening talk to the student nurses, recommended that a student form of government be adopted as the basis for the regulation of all students activities.

Acting upon this recommendation, the students were called together. At this meeting, three officers were elected—president, Miss Lyda S. Houston; vice president, Miss Lois West; secretary and treasurer, Miss Catherine Carton. These three officers, together with two members of the faculty, were appointed a committee to draw up a set of rules to be presented to the class for approval.

These rules provided for the future election of all officers, for the calling of student meetings, and for the governing of the student nurses both in the quarters and on the ground and in all social activities. The rough draft was presented by the committee to the student body for approval and adoption. Each rule was individually read and discussed before adoption. Some changes were made. The rules were next presented for approval, as supplementary to the Rules for Nurses as already issued by Colonel Michie to Miss Williamson, director, and to Colonel Michie, commander of the base hospital unit.

This form of government has proven to be of great benefit not only in the direction of all student activities, but as an organized means through which the faculty members and all officers can reach the student body. Student action has been much more effective and immediate than would have been possible in an unorganized state.

Several permanent committees, such as social, musical, dramatic, and athletic, have been appointed and have been the means of furnishing entertainment by the school.

This form of government and the rules approved and adopted govern not only the class which entered August 15, but also all student nurses sent for training to Camp Grant.

STUDENT QUARTERS AND ARMY TRAINING SCHOOL BUILDING

The student nurses' quarters at Camp Grant, base hospital, are located at the edge of the hospital grounds, a branch of the Rock River Valley cutting directly behind them. The quarters include three long narrow one-story frame buildings, well elevated from the ground, and connected by a roofed and railed wooden walk, which serves also as front veranda for all three. The back verandas, overlooking the gulch and with an interesting view of the river and rolling country to the westward, have not intermediary connection.

The general plan of the quarters' interiors, centers around the long hallway running directly through the building from the small front reception room to the rear veranda. Opening onto this hall from both sides are the 26 bedrooms, large lavatory, laundry and ironing rooms, and linen closet. The electric light and steam heat employed are from the camp power and heating plants. Fire protection is provided for in the regular fire buckets such as are used in wards and barracks, and by chemical extinguishers placed in the corridor. Ventilation is provided through a system of traps through the ceilings and transoms over each door.

The front reception room is furnished in dark willow and cretonne, with comfortable cushioned easy chairs. This reception room is also, in a way, the office of the quarters, matters of general interest to the quarters being adjusted there, bulletins and notices posted, and guests received.

The laundry and lavatory are fully equipped with all conveniences and supplied with abundant hot water at all hours. The ironing room is fitted with a board, and socket for the attachment of electric irons.

The most interesting part of the quarters is, of course, the bedrooms, one of which each student nurse has entirely to herself. The original furnishings included a white iron hospital bed, a dark wooden chair and bureau, with a large mirror, a built-in wardrobe, cupboard with upper shelf, closed wall writing desk, with shelves and compartments, and a little enamel rocker. The large window is fitted with marquissette sash curtains and the pine floor is partially covered by a simple dark rug. The woodwork is of unfinished pine, the walls of a soft tone of eeu wall board. All conducive to a general tone of quiet, refreshing simplicity. The student nurses take such pride in their little "homes" that they have completed the decoration with wardrobe curtains, dresser scarfs, and window drapes of cretonne or similar materials, with perhaps a simple print, or motto, and a few books on the writing desk, giving each room the individual touch so much to be desired. The students on entering had rather expected to be quartered in common barracks, with long rows of low bunks and crowded lockers for clothing. So their delight in being given individual rooms, so completely equipped with such thought to their comfort and convenience, can hardly be overestimated.

The school building stands just around the corner from the quarters. It is a large two-story building, with screened veranda running the full length of the building, upstairs and down. Downstairs are the recreation and dietetics rooms, with adjoining lavatories and offices; upstairs the lecture room and demonstration room. The ventilation, light, and heating system is similar to that of the quarters.

The recreation room is a point of pride to every student nurse, since its furnishing is largely the result of their own efforts. It is furnished in a quiet tone of blue-gray, as are the other rooms of the school, with window drapes and lamp shades of rose. Cretonne-covered divans, easy chairs, writing tables, with a supply of magazines, a victrola, and a piano complete the general equipment, though such brief enumeration must fail to carry the impression of each relaxed comfort which prevades the room.

The dietetics room across the hall is fitted with the long laboratory table with individual cupboards and drawers containing necessary utensils and supplies, as well as writing tables and chairs for note taking. Heat is provided through an electric range and a number of small electric heaters. Other supplies and articles not in constant use are kept in the small supply room adjoining, or, as soaps and dishpans, in the lavatory reserved for kitchen uses.

The Medical Department has been very generous in providing necessities for a thorough dietetics course.

Individual equipment

1 spatula.	2 bread tins (large and small).
1 paring knife.	1 custard cup.
2 tablespoons.	1 small teapot.
2 teaspoons.	3 white enamel bowls (1 large, 2 small).
1 knife.	1 white enamel utility plate.
1 fork.	1 small pie tin.
1 apple corer.	Food containers (salt, pepper, flour, sugar).
2 asbestos mats.	2 enamel saucepans (large and small).
2 measuring cups (glass and tin).	1 double boiler.
1 biscuit cutter.	1 small frying pan.
1 vegetable brush.	1 skimmer.
2 knives (large and small).	1 grater.
1 Dover egg beater.	1 electric plate.
1 egg whip.	1 gram scales (for two students).
2 tin covers (large and small).	

General equipment

1 ice box.	Potato urns.
2 electric stoves.	Lemon squeezers.
2 blackboards.	Chopping bowls.
2 stock pots.	Rolling pins.
3 large double boilers.	Butcher knives.
2 large enamel saucepans.	Glass tumblers.
Coffee pots.	Glass sugar and creamers.
Enamel pitchers.	Glass sherbert dishes.
Muffin tins.	China dishes.
Cake tins.	Silver.
Baking sheets.	Towels, etc.
Bread coolers.	

Upstairs the hallway is furnished with study tables and chairs for use in getting reference work. And one small office is fitted with shelves and set apart as a student's reference library.

The lecture room is provided with armchairs for note taking, blackboard and lecturer's desk, specimen cabinet, and a number of anatomical charts. For use in anatomical study an excellent skeleton has been provided, which when not in actual use is kept in gruesome seclusion in a corner of the library.

In the demonstration room across the hall used especially for the practical nursing course are four beds, with tables and a wheel chair. Linen and all other supplies necessary to nursing demonstration are kept in an adjoining linen closet. Most of all important in the equipment of this class room is Lucy, the demonstration doll. Jointed, washable, and never querulous, she makes an ideal patient.

Neither in quarters nor in school has anything conducive to the student's comfort and convenience, or essential to their professional training, been overlooked.

ROUTINE LIFE OF A STUDENT NURSE AT CAMP GRANT, ILL.

The life of an Army nurse, although supposedly arranged according to a regular routine, is nevertheless subject to the most unexpected and varied experiences.

We arise at 5.45, and at 6.25 must be ready to answer breakfast mess call, with our quarters in perfect order and ourselves in uniform, to go directly from the mess hall to the wards for our morning hours of duty.

The abundance and quality of the food and healthy appetites of the girls compensate for lack of niceties in service, and soon even the most fastidious only complain because meals are not closer together.

The daily hours between 7 a. m. and 7 p. m. are divided between ward work, classes and lectures, and drill. We average five hours a day ward work and one hour military drill. On the ward we make beds, give baths, rub backs, prepare diets, take temperatures under supervision of the head nurse, and with the help of corps men assist in the general tidiness of the wards.

No matter how tired we may be from ward or class work, an hour of military drill or a hike, in our Regular Army drill suits and with our own student officers, renews vigor and enthusiasms.

At 4.45 every night, except Saturday and Sunday, the hospital force stand retreat. Headed by the base hospital band, the medical officers, graduate nurses, student nurses, and enlisted men march up Hospital Street and, forming one long line, pay tribute to the flags of America and of the Red Cross, and they are lowered for the day. Differing from retreat in other parts of the camp, here the column of khaki is interrupted by a line of graduate nurses all in white, with Red Cross capes, and student nurses in blue uniforms, white collars and cuffs, and khaki sweaters.

Supper at 5.30 p. m., and one hour of ward duty in making the patients comfortable for the night, and our day is supposedly over at 7 p. m., with the evening free for study. Quiet hour is enforced by the quarters' proctor from 8.15 p. m., and all lights out at 10.30 p. m.

But how monotonous would our life be if such were the regular routine of each day. Between times we wash and iron our collars, cuffs, and caps, do the innumerable things a girl finds necessary to keep wardrobe and quarters respectable, her family and friends in good humor, and herself posted on camp rumors.

But most disastrous to the daily routine are the impromptu orders liable to be issued at any instant. Such orders supersede all others and may allow from 3 to 10 minutes for their execution. Among those most common are: A call to attend a special lecture, exhibits, demonstration, or picture show, a call to appear in full drill uniform for inspection, in nurses' uniform for pictures, or a general review for some visiting officer of Army or Nurse Corps.

All quarters and wards are inspected every Saturday at 9 a. m., and as often between times as any visiting official or commander so desires.

On Saturday afternoon we are free from all hospital and military duties, and on Sunday have only seven hours ward duty.

For delicacies not furnished at the mess hall and for necessities of everyday life, we may go to the regimental canteen in the base hospital proper, or to "The Hub," a little group of stores just across the reservation line and only a short distance from our quarters. Other places serving the student nurses are the Young Men's Christian Association, Knights of Columbus, and Red Cross buildings, and our own recreation and school building and the Liberty Theater over in the camp proper.

For a touch of civilian life we can go to Rockford on Saturday afternoons, with a real dinner in town and a picture show afterwards, but must be home again by 10.30 p. m.

ARMY SCHOOL OF NURSING, UNITED STATES ARMY BASE HOSPITAL, CAMP GRANT, ILL.— THE COURSE OF STUDY

The plan for the course of study for the Army training school is practically the same as that outlined by the standard curriculum for schools of nursing, published in May, 1919.

During the three years' course of training the time to be allotted the various services is approximately as follows:

	Months
Preliminary training.....	4
Medical nursing.....	7
Surgical nursing (4 months operating room, 4 months wards).....	8
Vacation.....	2
Contagious diseases.....	3
Mental nursing.....	3
Affiliation:	
Obstetrics.....	4
Public health.....	3
Pediatrics.....	3
Gynecology.....	1
Vacation.....	1
Total.....	36

The instruction given during the preliminary period of four months included the following subjects:

	Hours
Anatomy and physiology.....	70
Bacteriology.....	20
Hygiene.....	12
Chemistry.....	36
Dietetics.....	40
Nursing principles and methods.....	60
Anesthesia.....	4
History of nursing.....	10
Bandaging.....	12
Total.....	264
Military drill.....	120

In addition all students admitted in the first group completed and received credit in the gas defense course.

During the preliminary period class instruction was given to the various groups individually. For the first year's work it was possible to combine all students for the lectures given; all quiz and laboratory work was given by dividing the students into comparatively small groups.

The instruction during the remaining portion of the first year included the following subjects:

	Hours
Diet in disease.....	10
Pharmacy, dosage and solutions, materia medica.....	40
Massage.....	12
Elementary pathology.....	8
Medical nursing.....	20
Surgical nursing.....	20
Laboratory technique.....	14
Total.....	124

Thus by June 1, 1919, the first year's work was completed by all students, and classes were discontinued for the summer months. This made it possible to place all students on 8-hour ward duty.

Affiliations became effective May 1, 1919, when a group of 7 students was sent to Chicago Lying-in Hospital for training in obstetrics. June 1, 1919, 7 additional students were sent to the same place, 10 to the Children's Memorial for training in pediatrics, and 6 to the Rockford City Hospital for training in gynecology.

The entire student group was transferred from Camp Grant to Fort Sheridan June 21, 1919. Records show that on that date 67 per cent of the entire group of students entered at Camp Grant were still in training.

Statistics obtained from 97 of 112 student nurses originally assigned to United States Army base hospital, Camp Grant, Ill., relative to the composition of the student group.

Average age, 23.9

Occupation.—Teaching—all positions from that of teacher in district school to principal of high school: Seventy per cent were teachers or had taught (64 in number; 1 of 12 years' experience). Stenography, typewriting, and bookkeeping; clerical positions; commercial art; newspaper reporters; librarians; telephone operators; laboratory technicians; dietitians; social charity workers; probation officers; social settlement workers; playground workers; deputy treasurers; homekeepers (8 in number). Wage earners, 82 per cent; average wage, \$67; total monthly wage, \$5,114.

Monthly wage:	Number of earners
\$30 to \$50.....	11
\$50 to \$75.....	44
\$75 to \$100.....	14
\$100 to \$130.....	5
\$150.....	1

RECREATION

All work and no play makes Jill a dull girl. The truth of this was recognized in the organization of the Camp Grant branch of the Army School of Nursing, as was evidenced by the diverse fields of activity offered, with a view not only to reach every member but to present a pleasing variety as well. The arrival of the first class found definite provisions for this important phase of student life, and many developments have since resulted as the need and opportunity arose.

In the school building assigned to us, one large room was reserved to be used as a recreation room. This room was furnished with the view of meeting as many needs as possible. A charming color scheme of gray walls, rose window hangings and shaded lights, and couches upholstered in attractive cretonnes delights the eyes of all; desks with writing materials are

provided; and dear to the hearts of all the students are the phonograph and the piano. These furnish the music for many an impromptu dance and many are the songs sung there. This room has been the scene of several successful parties given by the various classes.

Besides dancing at the recreation room, the Red Cross building is thrown open to us every Friday evening. The early part of the evening is devoted to the instruction of those who wish to learn to dance; later in the evening all of the student nurses are invited to join in the evening's pleasure.

Music has been one of our most delightful forms of recreation. We are exceedingly fortunate in having a base-hospital band of unusual excellence. Band concerts are always attended and appreciated by the "blue nurses." On September 20, 1918, the first class of the training school gave a concert to raise money to help pay for our piano. With the aid of Sergeant Vorkeller and Private Hasse, of the base-hospital band, and supported by the orchestra, a very creditable performance was produced. The program consisted of several numbers by the band, choruses by the glee club, and solos.

Athletics have claimed the attention of most of the student body whenever the weather permits, and tennis, baseball played according to indoor rules, and hikes have received their full share of attention. Excellent tennis courts are close at hand, and stated times at which they are reserved for the use of the student nurses are prescribed. Not far from quarters is a level piece of ground, which makes an ideal baseball diamond, while the bank of the Rock River is one of the many paths which offer an irresistible temptation to obtain the necessary out-of-door exercise. When the weather no longer made it possible to indulge in these pleasures, equally interesting substitutes were provided in the form of basket ball, captain ball, and other indoor sports.

MILITARY DRILL

On August 19, 1918, under the command of Lieutenant Colonel Michie, commanding officer of the base hospital, the student nurses of the Camp Grant training school received their first instruction in military drill. A month later, upon the arrival of the second group of students, the student body was organized into two individual companies, each company electing its officers from its own group. Each company was divided into two platoons, each platoon under the command of a lieutenant. Upon arrival of new groups of students the same plan of organization was continued. On March 1, 1919, the following battalion staff was in command:

OFFICERS, FIRST BATTALION ARMY SCHOOL OF NURSING, ARMY NURSE CORPS, UNITED STATES
ARMY BASE HOSPITAL, CAMP GRANT, ILL.

Battalion staff:

Adjutant, First Lieut. Irene D. E. Hoyer, A. S. N.

Supply officer, First Lieut. Mary Ellen Gipson, A. S. N.

Supply sergeant, Battalion Supply Sergt. Mabel Hendrickson, A. S. N.

	Company A	Company B	Company C
Captain.....	Edith A. Spear.....	Doris Healey.....	Florence A. Marvyne.
First lieutenant.....	Mary Ellen Gipson.....	Irene D. Hoyer.....	Eugenie Williston.
Second lieutenant.....	Zola G. Slaughter.....	Eleanor Kennedy.....	Gladys L. Warrick.
			Mabel Hendrickson.
Staff noncommissioned officers:			
First sergeant.....	Mava M. Edwards.....	Lucile Baker.....	Louise Hast.
Sergeant.....	Ester F. Tyler.....	Ariel B. Anderson.....	Olga G. Olson.
	Synneve Y. Eikum.....	Helena Stevens.....	Edith M. Frohmader.
Corporal.....	Margaret Rundlett.....	Alice M. Broadbent.....	Laura L. Baker.
	Catherine P. Carton.....	Rhea Hunt.....	Pearl A. Ely.
	Lois G. Bishop.....	Mildred Burns.....	Ada E. Smith.
		Mary C. Sheer.....	

This list supercedes all previous lists.

By order of Captain Bauer:

IRENE D. E. HOYER,
First Lieutenant, A. S. N., Army Nurse Corps,
Battalion Adjutant.

Special insignia of rank for battalion officers was prescribed as an integral part of the uniform, to be worn at all times. The insignia of rank in the various grades was designated as follows:

(a) *Captains*.—(1) Three gold buttons, S. A. T. C. These buttons are to be worn on the left side of the front of the overseas cap, the center of each button to be placed according to the following dimensions: First button, $1\frac{3}{4}$ inches from center of cap and $1\frac{1}{4}$ inches above the lower margin of cap; second button, $1\frac{1}{4}$ inches to the left of the first button and $1\frac{1}{2}$ inches above the lower margin of the cap; the third button, $1\frac{1}{4}$ inches to the left of the second button and $1\frac{3}{4}$ inches from the lower margin of the cap. On each epaulet of the outdoor uniform, the first button to be one-half inch from the sleeve seam; other buttons to be spaced one-half inch from each other in the direction of the collar. On the right side of the collar of the olive-drab shirt, the first button one-half inch from front edge of the collar; additional buttons at 1-inch intervals from each other.

(2) Three chevrons (of the design in the possession of the battalion adjutant) on the forearm of both sleeves of the overcoat, apex of each chevron surmounted by a button. Material of these chevrons to be one-quarter inch flat luster black mohair braid; buttons three-eighths inch diameter, flat, cloth-covered, black.

(b) *First lieutenants*.—(1) Two gold buttons; two sleeve chevrons corresponding to the first button and chevron of the above-described captains' insignia.

(c) *Second lieutenants*.—(1) One gold button and one sleeve chevron corresponding to the first button and chevron of the above-described captains' insignia.

(d) *Noncommissioned officers*.—(1) Chevrons of the pattern prescribed for the corresponding grades of other branches of the United States Army, but distinctive for the Army School of Nursing, Camp Grant, Ill., in colors as follows: For the outdoor uniform, gold bars on navy blue, to be worn on both sleeves, midway between the elbow and the shoulder. For the olive-drab uniform, blue bars on olive drab, to be worn on the right sleeve only, midway between the elbow and the shoulder of both the overcoat and the olive-drab shirt. For the overseas cap, miniature metal chevrons, to be worn 1 inch to the left of the front seam of the cap and 1 inch from the lower margin of the cap.

Battalion inspection was held weekly by Colonel Michie, taking into consideration the following points:

	Battalion Staff	Company A	Company B	Company C
Discipline				
Appearance of uniform				
Drill				
Attendance				
Authorized absence				
General impression				
Remarks				
Total rating				
Order of companies				

All ratings were made on a percentage basis, and the companies formed in the following order in the battalion for the week following the posting of the report of the inspection.

With the color			Without the color	
Leading company ..	Color (center) ..		Leading (right) ..	
Second company ..	Leading (right) ..		Second (center) ..	
Third company ..	Rear (left) ..		Rear (left) ..	

When the ratings are equal, the order of companies from front to rear in column or right to left in line, will be A, B, and C.

The following schedule of military drill was prescribed by memorandum issued January 18, 1919.

	Monday	Tuesday	Wednesday	Thursday	Friday	Officer
Signal drill	A		B		C	Capt. A. J. Dahlstream, Q. M. C. Company commander. Capt. W. W. Bauer, M. C. Lieut. Col. H. C. Michie (Friday); Captain Bauer (Tuesday).
Signal or ordinary drill	B		C		A	
Drill instruction	C		A		B	
Battalion drill		A, B, C			A, B, C	

In addition to the sweater and helmet issued by the Red Cross, each student was supplied with a complete olive-drab outfit, consisting of olive-drab breeches, shirt, overcoat, spiral leggings, belt, and overseas cap, for drill during the winter months.

Military drill was discontinued in May, about 120 hours having been devoted to this course.

All members of the student battalion desire to express to Colonel Michie and his assistants their appreciation of the privilege of such excellent military drill and instruction as was given them.

ARMY LABORATORY SCHOOL, YALE UNIVERSITY, NEW HAVEN, CONN.^a

The Army Laboratory School at Yale University was the direct offspring, or, more correctly, the metamorphosis of the laboratory school, Fort Leavenworth. It was recognized by the Surgeon General early in the war that it would be necessary to supply, both at home and overseas, officers and men who were trained in laboratory methods developed by the Medical Department of the United States Army. A school for this purpose was established early in 1918, at the department laboratory of the Central Department, Fort Leavenworth, Kans. It became necessary, as the school increased in size, to occupy two large Infantry barracks and two sets of officers' quarters for the work of the school. These buildings were equipped with work benches, running water, and other material necessary for the school by the Quartermaster Corps of the post without cost to the Medical Department.

It was possible at Fort Leavenworth to train only a limited number of officers and men, but with the facilities available the school was able to place in the field 13 mobile laboratories, the personnel of each consisting of 1 officer of the Medical Corps, 1 officer of the Sanitary Corps, and 1 sergeant and 3 privates of the Medical Department. In addition to these mobile laboratories, 1 stationary laboratory was formed, the personnel of which consisted of 2 officers of the Medical Corps, 4 officers of the Sanitary Corps, and 12 enlisted men of the Medical Department. In addition to these units, a considerable number of officers and men were trained in the school and assigned to the laboratories and camps of this country.

It soon became evident that the supply of well-trained laboratory men would soon be exhausted and that it would be necessary to train men in the elements of bacteriology and chemistry. This fact, together with the constant increase of officers and men, rendered it necessary to secure larger quarters for the work. As no other buildings could be obtained at Fort Leavenworth, a medical officer was ordered to inspect the Medical Officers' Training Camp at Camp Greenleaf, Fort Oglethorpe, Ga., in the latter part of May, 1918, it being understood that money was available for erecting suitable buildings at

^a The history of this school is based on: "Report of the work of the Yale Army Laboratory School for the fiscal year ending June 30, 1919, by Col. Charles F. Craig, M. C., United States Army. On file, Historical Division, Surgeon General's Office.

this post for the purposes of the school. As a result of this inspection, it was found that buildings could not be erected at that place, no funds being immediately available, and that Camp Greenleaf could offer no better accommodations than did Fort Leavenworth. The commandant advised that the school should not be moved unless laboratory buildings could be promptly erected. An offer from the authorities of Yale University to furnish buildings to the Government for training purposes⁵³ was then investigated. It was found that Yale University was willing to provide classrooms and laboratories for the Laboratory School in the Brady Laboratory, another building known as the surgical laboratory, and in Kent Hall. These buildings were offered free of charge to the Medical Department and were capable of providing classrooms for from 50 to 100 officers and from 50 to 75 enlisted men. Dormitory space was offered by the university for both officers and enlisted men, the rental of the quarters for the enlisted men being placed at the sum provided for commutation of quarters by the Government. The university required that the Government furnish all apparatus except large apparatus such as incubators, etc., and all chemicals and other material used in the teaching of officers and men. The offer of the university would enable the school to handle about 300 officers and enlisted men without crowding in the classrooms, and clinical facilities were given by the New Haven State Hospital, which was immediately adjacent to the Brady Laboratory. In view of the facilities offered, it was recommended that the Laboratory School be moved to the Yale University as soon as possible, and on July 9, 1918, a laboratory school was ordered established at Yale University. Despite the fact that alterations were necessary in the buildings in order to accommodate so large a number of students, the school opened on August 1, 1918, the officers and enlisted men on duty at Fort Leavenworth having been transferred in the meantime. A large part of the equipment was brought from the department laboratory at Fort Leavenworth on the laboratory car "Reed," and requisitions were placed for other equipment, which arrived promptly, no time being lost because of lack of equipment.

It was soon found that the classrooms available would be inadequate for the officers and enlisted men, who were constantly increasing in number. This matter was brought before the president of the university and the Yale Corporation, who voted to erect a temporary building, without cost to the Government, adjacent to the Brady Laboratory. This building, which was completed in 18 days, consisted of two large rooms, one room capable of holding 100 officers and the other capable of holding 200 enlisted men at one time. This building cost the university approximately \$40,000. It was equipped with electricity and steam heat and furnished ideal laboratory classrooms for the school.

From August 1, 1918, until teaching at this school was discontinued January 1, 1919, a total of 1,016 officers and enlisted men served at this station. Of this number 460 were officers, of which 223 were officers of the Medical Corps and 237 were officers of the Sanitary Corps.

The signing of the armistice on November 11, 1918, brought to a conclusion the work of the school so far as the organization of laboratory units was concerned. The officers and enlisted men who were left at the school were gradually distributed to Army laboratories in this country, except those who were

discharged on their own application or for other reasons. Prior to this date there were organized at the school, from officers and men who had finished their course of instruction, 10 mobile laboratories, consisting of a total of 20 officers and 40 enlisted men, and 3 stationary laboratories, consisting of a total of 18 officers and 36 enlisted men. These units were organized for service with our armies in France, and practically all of the mobile laboratories had been ordered to the port of embarkation before the armistice was signed.

In addition to these units, the Yale Army Laboratory School supplied laboratory officers and men for base hospitals, evacuation hospitals, and mobile hospitals intended for service in France. In all 33 medical officers and 18 officers of the Sanitary Corps were assigned to duty with base hospitals, 12 medical officers and 2 officers of the Sanitary Corps to duty with evacuation hospitals, and 4 medical officers to mobile hospitals. In addition to the officers assigned to these hospitals, a total of 239 enlisted technicians who received their training at this school were assigned to these hospitals.

During August, 1918, an understanding was reached with the Rockefeller Institute whereby the Yale Army Laboratory School was to furnish every six weeks a class of 40 officers for advanced training in bacteriology and chemistry. This class was to substitute a similar class in advanced work which was instituted at the Yale Army Laboratory School. This measure was necessary in order to keep the Army supplied with officers properly trained in bacteriology and chemistry, as applied to the prevention of disease and its diagnosis in the field. Owing to the outbreak of the severe epidemic of influenza in September, 1918, it was impossible for this measure to be carried out, so that only one class of 32 officers was sent from the Yale Army Laboratory School to the Rockefeller Institute. Before the time had arrived for the sending of another class the armistice had been signed.

The influenza epidemic, which continued until December, interfered seriously with the work of the school as, owing to the shortage of medical officers, it was necessary to order 56 officers of the Medical Corps who were pursuing studies at the school to various camps for temporary duty. This, of course, interfered with the sending of units abroad and the training of officers for these units, and for about six weeks the work of the school was practically at a standstill.

In addition to the officers and enlisted men already spoken of as being sent to base hospitals, evacuation hospitals, and mobile hospitals and the Rockefeller Institute, laboratory officers were supplied to various other institutions connected with the Army, as department laboratories, Surgeon General's Office, St. Elizabeths Hospital, Bureau of Mines experimental station, the pathological section of the Chemical Warfare Service. Enlisted technicians were also supplied to these places as called for.

COURSE OF INSTRUCTION

The subjects taught at the Yale Army Laboratory School were bacteriology, pathology, clinical microscopy, and chemistry, so far as it related to clinical diagnosis and the examination of water, foods, and the detection of poisons.

BACTERIOLOGY

Two courses in bacteriology were maintained at the school, an elementary course for those who had little training in the subject before coming to the school, and an advanced course for well-trained bacteriologists. In addition, a course in bacteriology was maintained for enlisted men in order to qualify them as laboratory technicians.

During the early days of the school at Fort Leavenworth, as noted, the officers of the Medical Corps and the Sanitary Corps who were assigned for a course of instruction at the school were well-trained bacteriologists, and the course of instruction was designed to acquaint them with the special methods found of value in the diagnosis and prevention of disease. In order to supply the Army with these specially trained officers it would be necessary to train medical officers and officers of the Sanitary Corps, not only in advanced bacteriology, but also in the elements of the science, so that eventually it was found necessary to divide our officer students into two classes—those who had received good training before arriving at the school and those who had received little or no training in the subject. The first class was placed in the advanced course at the school, the second in the elementary course and afterwards in the advanced course.

The preliminary course consisted in instruction in elementary bacteriological technique and in milk and water analysis. Three hours a day were devoted to this work, and the course lasted approximately four weeks. In the advanced course special bacteriological methods were studied, especially those found of use in Army practice. This course was supposed to cover four weeks, but the time varied considerably, owing to the character of the preliminary training received by the officers who were placed in the course. The advanced course was at first limited to work on typhoid, pneumococcus, streptococcus, and meningococcus. Later, special emphasis was placed on the differentiation of pneumococcus, streptococcus, and the isolation and identification of influenza bacilli. Still later the identification of anaerobes was added to the course. Field conditions were duplicated as far as possible, the students being limited to the apparatus found most useful in field work. Three hours a day were given to the laboratory work, and a daily quiz was given in addition. A series of lectures designed to cover a period of five weeks on subjects of epidemiological and bacteriological interest was also a part of the course. Mimeographed notes of technique and information concerning the subjects taught were distributed to each student, and these notes enabled the instructors to handle a larger number of officers than would otherwise have been possible. When the school closed, the course in bacteriology was being conducted in the new temporary laboratory building, and 200 officers were under instruction, 100 in the morning and the same number in the afternoon.

The course in bacteriology for the enlisted men was intended to fit them for duty as laboratory technicians. While the school was at Fort Leavenworth a total of 105 enlisted men took the course; and during the five months in which the school was at New Haven, 403 enlisted men finished the course of instruction, making a total of 508 enlisted men who finished the course in

laboratory methods at the Yale Army Laboratory School since its establishment at Fort Leavenworth.

There was a very urgent demand for laboratory technicians, and the course was so conducted as to cover the greatest amount of work in as short a time as was compatible with the results desired. It was decided that six weeks was a sufficient period to train a man with intelligence in the work of a laboratory technician; as a matter of fact, it was demonstrated that this period is the minimum to be allowed for this purpose and much better results could be obtained if the course lasted eight weeks. The work consisted of one hour lecture, two hours of laboratory work, and one hour quiz every day with the exception of Saturday. On Saturday a review was held of the work of the preceding week. Owing to the great number of men taking the course, the class was divided into two sections, a morning and afternoon section. The course covered instruction not only in bacteriology but in clinical microscopy.

PATHOLOGY

A course in pathological technique was instituted at the Yale Army Laboratory School, and selected officers and men attending the school were given this special course. The instruction covered autopsy technique, museum technique, and histological technique. Approximately 125 officers were given instruction in pathology, but of these 100 were only in the preliminary stage of instruction when the school closed.

CLINICAL MICROSCOPY

The course in clinical microscopy was attended only by officers. It covered a period of five weeks, and all officers attending the school were obliged to take this course. One week was given to the chemical analysis and microscopic examination of urine, three weeks to the blood, and one week to other clinical laboratory methods. As the class of officers taking bacteriology was divided into two sections, a morning and afternoon section, it was possible to assign a section to the course of clinical microscopy when it was not in the bacteriological laboratory. Thus the officers who were taking bacteriology took the course in microscopy one half of the day and the course in bacteriology the other half of the day. As the two courses covered practically the same length of time, this arrangement was very satisfactory.

CHEMISTRY

The course in chemistry was conducted in the Kent Laboratory of Yale University in a laboratory classroom which would accommodate 100 students. The largest number of students attending this course at one time was 87, and at no time was the work interfered with for lack of room. During the time that the school was in operation at Yale University, 223 officers and 207 enlisted men received instruction in chemistry. The instruction in this subject consisted of water analysis, toxicology, methods of purification of water, and the identification of heavy metals and organic and other poisons. The preparation of Dakin's solution was thoroughly studied, and every officer and enlisted man was trained in its proper preparation.

At the time of the signing of the armistice, nearly 300 officers and over 500 enlisted men were receiving instruction in laboratory methods at the school. At this time the course had been so perfected that it was estimated that efficient laboratory officers could be graduated from the school in a period of eight weeks and enlisted technicians in a period of six weeks. It was the policy of the school to require that all officers attending the school receive not only the course in bacteriology but the course in chemistry. This was rendered necessary by the fact that only 2 officers, 1 bacteriologist and 1 chemist, were sent with field laboratories, and it was thought that the bacteriologist and chemist should be acquainted with both subjects in case of one being unable to attend to his duties from any cause. It was found that this policy was a good one and that even though officers might be ignorant of one of the subjects required, it was possible in the time allowed to impart enough instruction for them to attend to the ordinary work in that subject required in a field laboratory. A large number of chemists were sent to the Yale Army Laboratory School for instruction in chemistry who had received only very elementary instruction in bacteriology. It was found that when these men were placed in the class in bacteriology they took a great interest in this subject, many of them becoming very expert in it. This was not true, however, of medical officers who had training in bacteriology, when it came to the study in chemistry. So that while it was comparatively easy to make a good bacteriologist of the chemist, it was found that it was difficult to make a good chemist of a bacteriologist.

The Army Laboratory School established at Yale University August 1, 1918, was closed for instruction January 1, 1919. While this represents a period of five months during which the school was in operation, for over a month instruction ceased as far as officers of the Medical Corps were concerned, as 56 medical officers were sent to various camps during the influenza epidemic. At the time of the armistice the school was in a position to supply the Army with the necessary laboratory officers and technicians, and had the war continued it would have had no difficulty, it is believed, in keeping the Army supplied with these specialists.

ARMY MEDICAL MUSEUM^a

The Army Medical Museum is the first institution of the Medical Department of the United States Army organized specifically for educational purposes. It was founded in 1862, under Surgeon General Hammond.⁵⁴ Work was at once undertaken on the collection of a large amount of anatomical material, furnished by the aid of the medical officers of the Army, from the dead and wounded of the Civil War, with a view to the scientific preparation and preservation of suitable specimens which would show the action of injurious agents used in war upon the various tissues of the body, the results of complications of war wounds, and the effects of the various diseases affecting the armies upon the human body. It was intended that such material be used for the instruction of medical officers of the Army and other members of the medical profession.

^a This account is based, in the main, on a report of the activities of the museum, by Maj. George R. Callender, M. C., Mar. 30, 1925. Copy on file, Historical Division, Surgeon General's Office.

For a complete account of the museum see: *The Army Medical Museum—A History*, by D. S. Lamb, M. D., *Washington Med. Annals*, 1916, xv, No. 1, 15.

The material so collected, together with the specimens which have been added from time to time from the various hospitals of the Army, numbers many thousands of specimens, which have constituted a valuable source of pathological material for research and training, not only of medical officers of the Army, but of the medical profession at large. The initial collection was the basis of much of the work and most of the illustrations of the Medical and Surgical History of the War of the Rebellion.

Coincidental with these activities of the museum, a collection of photographs was made during the Civil War, and since that time, of many living cases showing the wounds of war in an open, partially healed, or healed condition. Some of these photographs have been used for exhibition purposes and display, others have been placed on file for reference purposes, while many were used in illustrating the Civil War history.

During the Spanish-American War little opportunity was afforded to collect material illustrating the wounds of war, but numerous specimens of the intestinal diseases, particularly typhoid, were collected and studied, though little of educational value was derived therefrom.

After the United States entered the World War, under the inspiration and direction of the curator of the Army Medical Museum, and to fulfill the demand for illustrated material, models and other agents intended to portray and interpret subjects for training of officers and enlisted men, the function of the Army Medical Museum was expanded to provide a means for the production and circulation of photographs, lantern slides, moving-picture studies, wax models, paintings and drawings of original subjects, to be used in immediate training as well as for permanent use in perpetuating the professional and other material in the archives of the Surgeon General's library and the collections of the Army Medical Museum.

The activities assumed such proportions as to require their administrative decentralization from the pre-war activities of the institution and the designation of "the instruction laboratory" as an affiliated section of the Army Medical Museum, with the following departments: (1) Still photography; (2) moving pictures; (3) anatomical art.⁵⁵

From its inception this laboratory functioned to the fulfillment of its designation. It engaged itself in the organization of trained individuals (officers and enlisted men), who operated to collect material from subjects for the preparation of moving-picture films, photographs, and lantern slides. The laboratory was at the disposal of the officers of the Medical Department in camps, hospitals, and other formations throughout the United States and in Europe, and prepared many thousands of photographs and lantern slides which were used to illustrate the instruction efforts of those engaged in the training of personnel for sanitary services.

In July, 1918, Museum Unit No. 1 was organized and sent overseas for the purpose of collecting pathological specimens, to supply the graphics of the movement of hospitals and other medical units, and to complete the histories of the medical and surgical cases by supplying moving pictures, still photographs, wax models, and colored sketches of these cases.⁵⁶ Many thousands of gross specimens and histological slides were received from the camps and hospitals at home and abroad, covering all the important diseases and injuries observed during the war.

Pathological material quite sufficient for exhaustive investigations of the diseases and wounds of the World War was added to the collection, which was thus increased to over 100,000 gross specimens.⁵⁷ The results of its study are presented in the various professional volumes of this history. The instruction in pathology of the classes at the Army Medical School was based on the material in the museum.

More than 20 enlisted men were especially instructed in the technique of the preparation and preservation of gross and microscopical material and were sent to the various hospital laboratories to preserve material for use of the museum.

Adequate laboratories for developing, assembling, and projecting moving pictures, based on like laboratories of commercial establishments, were placed in operation at the museum, and the instruction laboratory made, produced, and circulated a number of moving-picture films and to a large extent exploited and proved the value of the motion picture on instruction and training.

The value of the training material produced by the laboratory during its existence can not be overestimated, particularly in that it serves as a permanent illustrated history of the work of the Medical Department, as well as a nucleus for training in time of peace.

There now are on file in the Army Medical Museum approximately 30,000 photographs, 120 moving-picture studies of 280 reels, and about 1,000 lantern slides.

As the material for training was collected and expanded, a circulation department was operated in order that this most valuable instruction material would be made immediately available for the courses conducted in camps, hospitals, and other formations. The laboratory did not confine itself to the production of studies for the Medical Department solely, but made an exhaustive study of the necessity for the preparation of material which, by its influence on the basic training of the soldier, would prevent disease, develop morale, and sustain esprit in the Army. Several of these were classical presentations of the venereal problems in its relation to the production of noneffectiveness and disability.

Many valuable pictures of specimens were made by the anatomical artists on duty at the museum, of influenza and pneumonia subjects and the pathological effects of gassing. A great many were produced by the unit in France and forwarded to the museum at the close of the war.

Some 200 wax models illustrating wounds and diseases were made and added to the large collection of moulage work already in the museum. These new specimens are of much better character than the old and have been extensively copied for the purpose of instruction in the medical schools of the country.

The moving-picture department later in the war took pictures of actual operations in training and in combat in the field in Europe and this country, illustrating treatment of the wounded, the training of the officer and enlisted man of the Medical Department, and films descriptive of the various special forms of treatment in the branches of surgery and medicine. The following are prominent among the films produced and circulated for instruction purposes during the period of training: "Training

of the Medical Officer"; "The Regimental Detachment"; "The Field Hospital Unit"; "The Ambulance Company"; "Diagnosis of Tuberculosis"; "Fighting the Cootie"; Mosquito Eradication"; "Activities of the M. O. T. C. at Fort Benjamin Harrison"; "Courtesy"; "The Care of the Horse or Mule"; "Disabilities of the Soldiers' Feet and Treatment"; "The Army Nurse"; "Empyema"; "Exercises for Preventing and Correcting Flat Feet"; "Harness and Harnessing"; "The Housefly"; "Infantry Pack and Equipment"; "Nerve Wounds"; "Reconstruction"; "Simple First-aid Hints."

Although this historical review of the activities of the instruction laboratory as a part of the training efforts of the Medical Department for actual participation in the war is brief, the influence which the result of its work reflected as a part of the program of instruction of personnel of the Medical Department was most beneficial.

The results of the work of this institution are perpetuated in the archives of the Army Medical Museum in the form of a comprehensive collection of moving-picture films intended for teaching purposes, a well-balanced library of photographs of the activities of the Medical Department at home and abroad, and a valuable collection of models and other material which were valuable instruments for general and special training during the war, and probably of greater value in preparation for future conflicts.⁵⁸

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- (50) Memorandum from the Surgeon General, U. S. Army, to the Secretary of War, May 24, 1918. Subject: Approval of plan for Army School of Nursing; and indorsement of the Secretary of War, May 25, 1918, which is approval thereof. On file, Record Room, S. G. O., 352.4 (Army School of Nursing).

- (51) Letter from the committee (Dora Thompson, superintendent, Army Nurse Corps; Jane Delano, director, bureau of nursing, American Red Cross, and Annie W. Goodrich, chairman, chief inspecting nurse), to the Surgeon General, March 24, 1918. Subject: The plan for the creation and operation of an Army School of Nursing. Copy on file, Historical Division, S. G. O.
- (52) Report of the Student Nurse Battalion, Army School of Nursing, History of the U. S. Army Base Hospital, Camp Grant, Ill., October 14, 1917, to July 23, 1919, Volume 1, 119. On file, Historical Division, S. G. O.
- (53) Correspondence between Yale University and the Surgeon General. Subject: Medical department of Yale University for war purposes. On file, Record Room, S. G. O., 324.3 (Tender of Services); 220.3 (New Haven, Conn.) F.; 353 (New Haven, Conn.) F.; 353 (Laboratory Instruction); 700.7 (Yale Army Laboratory School).
- (54) Circular No. 2, S. G. O., May 21, 1862.
- (55) History of Medical College Illustrative Instruction, prepared under the direction of the division of military orthopedic surgery, by R. Tunstall Taylor, colonel, M. R. C. On file, Historical Division, S. G. O.
- (56) Letter from the Surgeon General to the commanding officer, Museum Unit No. 1, Army Medical Museum, August 5, 1918; memorandum to the Surgeon General from the curator of the Army Medical Museum, August 6, 1918; S. O. No. 185, W. D., August 9, 1918, par. 461; letter to the Surgeon General from the commanding officer, Museum Unit No. 1, August 10, 1918. On file, Record Room, S. G. O., 322.3 (Museum, Unit No. 1) V.
- (57) Weekly reports from Maj. C. Judson Herriek, S. C., August 8 and 22, 1918. On file, Weekly Report File, Record Room, S. G. O.
- (58) Report to the Surgeon General, U. S. Army, by Col. W. O. Owen, on the instruction laboratory, Army Medical Museum, December 10, 1918. On file, Historical Division, S. G. O.

CHAPTER VII

PROFESSIONAL SCHOOLS IN MILITARY AND NONMILITARY INSTITUTIONS

In making plans for the care of the wounded overseas it was realized, especially with respect to fractures, that the treatment should be so systematized that the wounded soldier would be under one method from the time he was injured until he left the hospital. In order to accomplish this it was important (1) that there be adopted a standard method of treatment; (2) that medical officers be trained in the use of standard appliances and methods. The latter was the more formidable of the undertakings. This was accomplished, in part, by establishing classes, under eminent surgeons, in various medical centers and sending them, upon the completion of the courses, to the medical officers' training camps and base hospitals to assist in the instruction along the given line.

To this end there were organized, in military and nonmilitary institutions, exclusive of medical officers' training camps, divisional camps, posts, and base and general hospitals, schools for the instruction of medical officers in the diagnosis and treatment of conditions coming within the range of certain of the medical and surgical specialties.

United States Army Auxiliary Hospital No. 1 (war demonstration hospital), Rockefeller Institute, New York City, may be said to occupy an intermediary position, since it was, so to speak, a military organization engrafted upon a nonmilitary institution.

MILITARY INSTITUTIONS

SPECIAL SCHOOLS FOR TRAINING IN DIAGNOSIS AND TREATMENT

PNEUMONIA SCHOOL, BASE HOSPITAL, CAMP JACKSON, S. C.^a

With the concentration of large numbers of men in Army camps, acute respiratory disease was immediately recognized as a very important problem confronting the Medical Department of the Army. Measures were instituted which aimed to prevent the spread of infection by contact with those showing evidence of mild inflammation of the upper air passages. Attempts were made to protect soldiers who volunteered for the purpose against pneumonia by prophylactic vaccination. In addition, efforts were made to discover the bacteriological agent responsible for each individual infection, in order that epidemiological measures might be more intelligently formulated and serum therapy instituted if the type of infection could be influenced by it.

This program required the cooperation of trained epidemiologists, bacteriologists, and clinicians. Courses in bacteriology were arranged and medical officers detailed to them for periods of study. An opportunity for clinical and laboratory training in the care of acute respiratory diseases was offered by the

^a Based on: Clinical Instruction in Acute Respiratory Disease, Camp Jackson, S. C., by Henry T. Chickering and James H. Park, jr., Copy on file, Board of Publications, Surgeon General's Office.

hospital of the Rockefeller Institute (q.v.p. 493), which received patients suffering with pneumonia for treatment and study. Beginning November 1, 1917, medical officers were detailed to that hospital for instruction. They served as internes, were responsible for the ordinary clinical care of the patients, and in addition they performed all the laboratory work in connection with their patients.

In May, 1918, in addition to the instruction offered at the hospital of the Rockefeller Institute, a similar course of study was begun at the base hospital, Camp Jackson, under the direction of a medical officer who had assisted in the training at the Rockefeller Institute.¹ This camp, with a population of from 30,000 to 60,000 men, furnished ample clinical material throughout the summer months.

To facilitate this study of acute respiratory diseases, the chief of the laboratory provided one room which became known as the laboratory of the pneumonia school. A special appropriation was granted by the Surgeon General to equip this laboratory and to purchase the necessary supplies, materials for culture media, and laboratory animals. Here it became possible for every officer to become familiar with the cultural characteristics and pathogenicity of the common bacterial flora of the nose, throat, and deep respiratory passages. Cultures were made from the secretions of the nose and throat and from the sputum, on blood agar and Avery medium. Mouse inoculations with sputum to facilitate the determination of the type of pneumococcus were made in each case. In addition lectures were given on the bacteriology of the respiratory tract and the clinical application of the laboratory study of acute infections.

During the summer two wards, of 32 beds each, were provided for the treatment of cases of acute respiratory disease. Upon admission to the base hospital all patients were held in reception wards until a tentative diagnosis allowed of their proper distribution.

The observation wards were situated close to the bacteriological and Roentgen laboratories. Fluoroscopic examination of the chest proved of diagnostic value in the very early stages of bronchopneumonia and lobar pneumonia and was always resorted to when patients complained of symptoms referable to the respiratory tract, even though by physical examination no signs of pulmonary involvement could be detected. When clinical examination was unsatisfactory, the fluoroscope frequently revealed increase in density in localized areas of the lung and restriction of the movement of the diaphragm on the affected side. In addition, specimens of sputum and blood could often be obtained for examination a day or more before signs of definite consolidation were evident.

At Camp Jackson officers were detailed to the pneumonia school for instruction for periods of one month, there being usually 6 or 7 men in each class. The patients were assigned in rotation, so that ordinarily each physician would have not more than 10 or at most 12 under his care at once. Each student learned to recognize the difficulties incident to the accurate study of the bacterial flora of the nose, throat, and pulmonary infection. In order to insure an intelligent prognosis, emphasis was placed upon repeated sputum examinations when only a pneumococcus of Type IV was found.

When serum treatment was indicated, instruction in the proper method of intravenous administration was given, together with the technique of determining the individual's sensitiveness or lack of sensitiveness to horse serum. By attention to these details no accidents attributable to serum were experienced.

From May 27 to September 15, 1918, upon which latter date the so-called influenza epidemic commenced at Camp Jackson, 192 cases of pneumonia were treated in the pneumonia wards by officers detailed for duty in the pneumonia school, and 20 officers were given instruction. The mortality of the cases treated was 7.7 per cent.

SCHOOL FOR THE DIAGNOSIS AND TREATMENT OF TUBERCULOSIS AND THE
ADMINISTRATION OF TUBERCULOSIS HOSPITALS, UNITED STATES ARMY GEN-
ERAL HOSPITAL NO. 16, NEW HAVEN, CONN.

In February, 1918, the Surgeon General recommended leasing, for use as a general hospital for the treatment of tuberculosis, the William Wirt Winchester Memorial Tuberculosis Hospital, situated 2 miles west of New Haven, Conn., and then just nearing completion.² This suggestion was approved by the Secretary of War, and the lease was executed.³ The hospital was opened for sick soldiers on March 7, 1918,⁴ and on March 21, 1918, it was designated General Hospital No. 16.⁵

A school of instruction was organized in this hospital for the training of medical officers in the physical diagnosis and treatment of tuberculosis and in the administration of general hospitals, including the duties of officers assigned to the various departments of general hospitals especially those for the treatment of tuberculosis, with the view of training medical officers for service at tuberculosis hospitals.⁴

The courses covered a period of six weeks. The instruction was largely practical. The microscopical appearance of tuberculous lesions was presented and the relation of these lesions to the clinical course and to the physical signs. The interpretation of X-ray plates was stressed particularly from the clinician's point of view.

The following subjects were covered: ⁴ (1) Physical diagnosis (normal and pathological chest). (2) Administration of wards in a general hospital, especial attention being given to treatment and record work. (3) Routine laboratory work. (4) Interpretation of X-ray plates. (5) Diagnosis and treatment of nasopharyngeal conditions. (6) General pathology, with special attention to the lung, with capital autopsy study. (7) Treatment of tuberculosis. (8) General administration of a military hospital, with practical work by: (a) Commanding officer, (b) supply officer, (c) mess officer, (d) adjutant, (e) registrar. (9) Military instructions by the detachment commander: (a) Management of a medical detachment, (b) drill, (c) setting-up exercises. (10) Reconstruction work. (11) Special instructions in the rapid examination of recruits.

The number of medical officers who took the course was 257.⁴ The distribution of medical officers who attended the school was as follows:⁴ Assigned to other hospitals as ward surgeons, 103; to special examining boards, 77; to base hospitals as specialists in lung diseases, 4; commanding officer in general

hospital, 3; medical chief in general hospitals, 2 of whom later became commanding officers, 7; other assignments, 18; discharged or transferred to other sections of the Medical Department as not suitable for this section, 24.

Some medical officers of the Regular Medical Corps took this course of instruction, which was more comprehensive and of longer duration than any of the similar courses given. The principal benefits arising from the course were the standardization of methods, the learning of the exact meaning of the terms employed in tuberculosis work, the manner of making diagnosis, the interpretation of physical signs, and the common method of treatment.

All courses of instruction were discontinued on October 7, 1918, on account of the influenza epidemic, and the instructors used as consultants in the influenza wards.⁶

SCHOOL FOR INSTRUCTION IN CARDIOVASCULAR DISEASES, UNITED STATES GENERAL HOSPITAL NO. 9, LAKEWOOD, N. J.

It was early determined by the Surgeon General that the medical staff of each of the large base hospitals should include a cardiovascular specialist; that is, an officer with adequate training in the modern aspects of cardiac diagnosis, including a familiarity with the use of the polygraph and the electrocardiograph. In order to supplement the supply of officers with these qualifications a course of instruction was given at the hospital of the Rockefeller Institute in the summer and autumn of 1917.

Considerable difficulty was experienced in securing a sufficient number of properly qualified cardiovascular examiners, and it was soon found necessary to establish at the medical officers' training camps at Fort Riley and Fort Oglethorpe special courses of training for such examiners. These were short intensive courses, taking only from two to three weeks and designed to meet the special diagnostic requirements of the cardiovascular examinations.

Upon the opening, in June, 1918, of General Hospital No. 9, at Lakewood, N. J., with its special heart service, courses of instruction in cardiac diagnosis and also in the management and physical training of the functional heart disorders were begun there and were continued up until the time of the closing of the hospital.⁷

The need for specially trained officers to take over the management of the great number of cases of irritable heart which were accumulating in the camps of this country and of France became very great, for the results of treatment were found to depend largely upon the skill and special training of the officer assigned to their care. By an arrangement made with the British authorities, a certain number of our medical officers, selected for such special work in the American Expeditionary Forces were given a few months of valuable training at the Army heart hospital at Colchester, England, before proceeding to their stations in France.⁷

The problem of the hospital care of the heart cases, especially of those cases returned from overseas, came in for much consideration and discussion and was finally met by the decision not to attempt to concentrate all heart cases in special heart hospitals, but to designate a number of general hospitals to which heart cases might be sent, and to use one hospital (General Hospital

No. 9, Lakewood, N. J.) for the special study of the form of heart disorders which constituted the real heart problem of the Army, namely, the functional disorders known as the irritable heart of the soldier.⁷

For this purpose a special heart service was established in the hospital, which was supplied with thoroughly equipped laboratories and a staff of especially trained assistants. Much valuable information was obtained from the study of these cases and, following the lead of the British Army, methods of treatment by means of graded physical exercises were developed and standardized.⁷

The following outline issued by the Surgeon General's Office for use at the medical officers' training camps was enlarged upon, the course extending, at first, over a period of three weeks and later including an additional week's instruction in nephritis and arthritis.⁸

OUTLINE OF CURRICULUM FOR A COURSE IN PHYSICAL DIAGNOSIS OF THE CARDIOVASCULAR SYSTEM AND OF HEART DISEASE, OF TWO WEEKS' DURATION

One hour, anatomy of the normal heart and physiology of the circulation.

Eight hours, physical examination of the normal cardiovascular system. Attention in these eight hours of practical exercises should be given to the following subjects:

1. Inspection of the heart and all peripheral vessels.
2. Palpation of the cardiac impulse and of the peripheral vessels.
3. Outlining by percussion the area of cardiac dullness and of dullness over the great vessels.
4. Auscultation of the heart, with special reference to the quality of the first sound.
5. Estimation of pulse rate and of blood pressure.

(The examinations indicated in 1, 2, 3, 4, and 5 should be made both in the upright and in the dorsal position; those in 2 and 4 should be made likewise when the patient is lying first, on the right, and then on the left side. The examinations indicated in 1, 2, 4, and 5 should be made before and after varying degrees of exercise, and particular attention should be paid to the alterations induced by exercise.)

Eight hours, study, by methods indicated above, of such functional deviations from the theoretically normal as—

- (a) Cardiorespiratory murmurs.
- (b) Systolic murmurs in the absence of hypertrophy.
- (c) Sinus arrhythmia.

One hour, consideration of Circular No. 21.

Four hours, consideration of irregularities. (Here stress should be laid upon such irregularities as those produced by sinus arrhythmia and premature contractions, since these are irregularities which occur most commonly in young men and are of military importance.)

Twenty-six hours, practical examination of abnormal cardiac lesions with special reference to diagnosis and military prognosis. During this period, one hour should be devoted to the significance of the history of infectious diseases such as rheumatism, chorea, tonsillitis, and of such incidental complaints as growing pains, in estimating the importance of the physical signs which are present; consideration of the subjective symptoms of heart failure and to a discussion of the physiology of heart failure and its early and late physical signs. Two hours should be devoted to functional cardiac disorders (the "irritable heart of soldiers," Da Costa; "effort syndrome" or "D. A. H." of Lewis.)

One hour, special differentiation of this functional cardiovascular disorder from mitral stenosis.

One hour, treatment of functional cardiovascular disorder.

Thorough history taking was regarded as a very important part in the study, classification, and grouping of cases. The following is an outline for history taking, as used in the instructions to new ward men:⁹

HISTORY TAKING

I. Family history. Aside from the routine history, inquire for evidence of neurological, neurotic, or hysterical disturbances. Also history of alcoholism, drug habits, etc.

II. History of infancy and childhood. Diseases; conditions that might have influence on later development; early nervous manifestations; enuresis, chorea, fainting attacks, etc.

III. School history. Progress in studies; final grade and at what age; leaving school; games and sports; if sedentary, learn why.

IV. Occupational history. If there has been a frequent change of work, learn why; nature of last work before military service; heavy or light work, with or without symptoms; time lost from illness or symptoms.

V. Personal history. Sexual; alcohol; tobacco, etc.

VI. Military History. Date of entrance; enlistment or induction; history of service in American camps; full or light duty; if latter, why; dates of transfer to various camps in United States; overseas service—after O. S. examination or not; date of sailing; overseas service (where performed; full or light duty; if latter, why; illnesses and hospitals entered; give dates and names; date of return to United States; record after landing in United States; date of entrance into No. 9).

VII. Present symptoms, with duration and asserted cause.

VIII. Anything in the general attitude, mental or otherwise, that might be an aid in analyzing an existing nervous condition.

NOTE.—Organic as well as functional cases should be analyzed for evidence of any form of inferiority; as, intelligence defects; chronic invalidism; neurotic or hysterical manifestations; focal disturbances; reactions of the emotionally sensitive; etc.

GROUPING OF THE NONORGANIC CASES BY MEANS OF HISTORY STUDY

I. Nonorganic cases; effort syndrome.

a. Physical strain. Have carried on well at the beginning of training, but gave out on severe effort; normal history previous to service; may occur after a return to full duty following too short postoperative convalescence.

b. Postinfections.

(*a*) Following rheumatic fever.

(*b*) Following other infections. Careful study fails to show any signs of organic disease.

c. Constitutional inferiority.

(*a*) Intelligence defects. May not be physically weak; lack ambition and push.

(*b*) Physical inferiors; chronic invalidism; may show full normal mentality; often have associated neurotic characteristics.

d. Emotionally sensitive. Break under severe, sudden nervous strain; retention of fears for long period; previous history usually normal.

e. Neurotic. Somatic manifestations; fainting, vomiting, etc.

f. Neurological. Basis of organic disease; epilepsy, old meningitis, etc.

The most common types in cases from the American camps are the physical inferiors and the primarily neurotic.

The following exercises were in use in the cardiovascular service in the treatment of cases and instructing personnel for cardiovascular work:⁹

GRADED EXERCISES FOR THE CARDIOVASCULAR SERVICE, GENERAL HOSPITAL No. 9, LAKEWOOD, N. J.

These graded exercises are used in the study of both organic heart disease and in those cases showing the symptom-complex of the effort syndrome. The exercises are arranged on a basis of eight units in the following order: (1) Arms; (2) head and chest; (3) balancing; (4) trunk bending forward and backward; (5) arms, legs, and feet; (6) trunk bending sideward; (7) marching, running, etc.; (8) breathing. The order of the units is the same in each grade. In the lowest grade, the movements are given slowly. With the advancement

through the grades, the movements are given in faster time and with increased snap to the commands. By use of this unit plan the exercises are easily graded from the most simple to the complex. All exercises are given twice a day. The sixth, highest grade, includes work in double time, with a period for games.

A medical officer is present at all exercises. It is his duty to detect the earliest signs of effort on the part of the organic cases and immediately refer them for examination. By encouragement, discipline, and general talks on physical development to the functional cases, he is able to keep them up to their full effort. Repeated examinations of functional cases is avoided. This medical officer has charge of the strength tests. This test is made on each patient when he first begins exercises, and is repeated every four weeks until the man is discharged from the hospital.

INTERPRETATION OF THE COMMANDS

Arms forward: Arms straight, shoulder high and shoulder width apart, palms inward.

Arms fore upward: Arms raised upward by passing through arms upward position.

Arms sideward: Arms shoulder high, hands slightly behind the line of the shoulders, palms downward.

Arms side upward: Arms raised through arms-upward position, palms turned inward as the arms are raised upward above the shoulders.

Arms backward: Arms raised over head and backward as far as possible, with chest raised.

Hands on hips: Hands firmly on hips, thumbs to rear, elbows and shoulders well back.

Arms bent for thrust: Arms bent, elbows close to sides, forearms vertical, hands clenched at side of shoulder, knuckles outward.

Arms bent for strike: Hands clenched over shoulders, knuckles to the rear, elbows shoulder high and well back.

Support line frontways: Weight supported on hands and toes, the arms, trunk, and legs straight.

Trunk bent forward; Back bent as much as possible, head up, knees straight. Heads lead in return movement.

Trunk lowered one-half forward: Back flat, head up, trunk carried midway between vertical and horizontal positions.

Trunk lowered forward: Back flat, trunk to horizontal, head up.

Trunk bent backward: Chest raised, head and neck lowered backward as a unit, chin in, knees straight. The bending is in the upper spine.

Trunk bent sideward: Body bent directly sideward, knees straight, feet flat on the floor.

Chest raised: The chin drawn in and the chest raised upward and forward.

Heels raised: Heels raised, ankles fully extended, weight on toes, heels slightly separated.

Knees bent: Heels raised and slightly separated, knees bent outward, body erect, head up.

Leg raised: Body held erect, chest raised, leg raised as high as possible, knee and ankle extended.

Foot placed: Foot placed in given direction, toes touching floor, leg straight, weight on stationary foot. Feet about 18 inches apart.

Stride: Weight equally divided on both feet, feet flat on floor. Feet about 24 inches apart.

Side step: In given direction, weight transferred to stepping leg, heel of stationary foot raised. Distance about 24 inches.

Lunge: Leg raised and step taken in given direction, knee of stepping leg bent, feet flat on floor, body erect. Distance about 24 inches.

Feet closed: Inner edges of feet together, knees pressed together.

Head lowered backward: Chin drawn in, head and neck lowered backward as a unit.

RHYTHM OF MOVEMENTS

Arm and leg movements are usually taken in fast rhythm.

Trunk and head movements are always taken in slow rhythm.

The balancing exercises are done on count or command. These are the third exercises in each group.

In compound exercises, the rhythm is that of the slowest movement.

UNITS OF EXERCISES

Each lesson consists of eight exercises or units and the order of these should not be changed.

- | | |
|--------------------------------|----------------------------|
| 1. Arm, leg, and foot. | 5. Same as unit 1. |
| 2. Head and chest. | 6. Trunk sideward. |
| 3. Balancing. | 7. Marching, running, etc. |
| 4. Trunk forward and backward. | 8. Breathing. |

EXERCISES

Grade I (15 minutes)

1. Raise arms side upward (1). Return (2).
2. Arms bent for thrust: Straighten arms sideward and raise chest (1). Return (2).
3. Bend arms for thrust: Raise heels and chest (1). Return (2).
4. Hands on hips: Lower trunk one-half forward and exhale (1). Return (2).
5. Bend arms for thrust (1). Straighten arms upward (2). Return (3, 4).
6. Hands on hips: Bend trunk left (1). Return (2). Right (3, 4).
7. March in place (1 minute).
8. Raise arms sideward and inhale. Lower and exhale.

Grade II (15 minutes)

1. Arms bent for thrust: Thrust arms forward (1). Return (2).
2. Raise heels and chest. Inhale (1). Return (2).
3. Bend knees one-half deep (1). Return (2). (Hands on hips.)
4. Hands on hips: Raise chest and inhale (1). Lower trunk one-half forward and exhale (2). Return (3, 4).
5. Arms bent for thrust: Swing left leg forward (1). Return (2). Right (3, 4). Trunk kept erect.
6. Side stride stand: Bend trunk left sideward and raise right arm side upward (1). Return (2). Left (3, 4).
7. March in place (2 minutes).
8. Raise arms fore upward and inhale. Lower side downward and exhale.

Grade III (20 minutes)

1. Raise arms fore upward (1). Return (2). Raise arms side upward (3). Return (4).
2. Raise arms forward (1). Move arms sideward, raise chest and inhale (2). Return (4).
3. Bend knees and raise arms sideward (1). Return (2).
4. Side stride stand: Hands on hips. Lower trunk forward (1). Return (2).
5. Arms bent for thrust: Swing left leg sideward (1). Return (2). Right (3, 4).
6. Arms bent for thrust, feet closed: Turn trunk left (1). Return (2).

Grade IV (25 minutes)

1. Raise arms backward (1). Swing arms fore upward (2). Return (3, 4).
2. Bend arms for thrust and lower head backward (1). Return (2).
3. Raise left leg forward and arms sideward (1). Return (2). Right (3, 4).
4. Side stride stand: Swing arms fore upward (1). Bend trunk forward and touch floor (2). Return (3, 4).
5. Raise heels and raise arms side upward (1). Bend knees, arms sideward (2). Return (3, 4).

6. Feet closed, arms sideward: Turn trunk left (1). Return (2). Right (3, 4).
7. Hike (15 minutes).
8. Hands front of shoulders: Straighten arms sideward, palms up, and inhale (1). Return and exhale (2).

Grade V (35 minutes)

1. Feet closed, arms bent for thrust: Turn trunk left and thrust right arm forward (1). Return (2). Right (3, 4).
 2. Arms bent for thrust: Straighten arms sideward, palms up, raised chest, and inhale (1). Return (2).
 3. Raise arms sideward and left leg forward (1). Move left leg backward and lower trunk one-half forward (2). Return (3, 4).
 4. Hands front of shoulders: Lower trunk one-half forward and exhale (1). Raise trunk, raise arms sideward, and inhale (2).
 5. Arms bent for thrust: Lunge left and thrust sideward (1). Return (2). Right (3, 4).
 6. Hands on hips: Turn trunk left (1). Bend trunk forward (2). Return (3, 4).
 7. Run in place (20 seconds). Breathing exercises. Repeat the run.
 8. Raise arms forward and inhale. Lower sideward and exhale.
- The free exercises cover about 20 minutes and should be taken in full time with brisk, snappy rhythm.

Grade VI (60 minutes)

1. Bend arms for thrust and place left foot back inward (1). Lunge left sideward and thrust arms sideward (2). Return (3, 4).
2. Stop left forward, raise arms sideward, raise chest and inhale (1). Return (3).
3. Raise left leg backward, hands front of shoulders (1). Lower trunk forward, arms sideward (2). Return (3, 4).
4. Lunge left sideward and bend arms for thrust (1). Thrust arms sideward and lower trunk forward (2). Return (3, 4).
5. Bend knees and place hands on floor (1). Support line frontways (2). Bend arms (3). Return (4, 5, 6).
6. Side stride stand, hands on hips: Bend trunk forward (1). Circle trunk left (2). Backward (3). Right (4). Forward (5). Raise trunk (6). Repeat, with circle trunk right.
7. Run in place (1 minute).
8. Raise arms fore upward and inhale. Lower side downward and exhale. Vigorous games (15 minutes). Games: Dodge ball, cage ball, volley ball, relay races, basket ball, tag games, etc. Hike (20 minutes). Part of hike in double time and rest in quick time. A swim may be substituted for part of hike.

UNITED STATES ARMY AUXILIARY HOSPITAL NO. 1, WAR DEMONSTRATION HOSPITAL,
ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK CITY ^b

The various war activities of the Rockefeller Institute for Medical Research were made possible on the large scale on which they were conducted through the aid of the Rockefeller Foundation, which supplemented the available funds of the institute in a generous manner. Through the large appropriations made to the institute by the foundation for war purposes, the institute was enabled to undertake certain teaching and other activities which it was in a position to conduct with advantage.

^b The statements of fact appearing herein are based, in the main, on the "History of United States Army Auxiliary Hospital No. 1, New York City," by Maj. George A. Stewart, M. C., United States Army, while on duty as a member of the staff of that hospital. The material used by him in the compilation of the history comprised official reports from the various divisions of the hospital. The history is on file in the Historical Division, Surgeon General's Office, Washington, D. C.—*Ed.*

These war activities, for the most part, were outside the normal work of the institute as designated by its founder and board of trustees; however, the imminence of war with and then later the actual declaration of war against Germany, led the corporation of the institute to readjust its general kinds of activities, in order to place the facilities of the institution on a war basis.

Fortunately, the institute had made contributions looking toward the prevention and curative treatment of disease which offered immediate application to some of the medical problems likely to arise in connection with the greatly enlarged personnel of the Army and Navy, and with the inevitable casualties of large training camps in actual warfare. For example, the institute had worked out curative sera for epidemic meningitis and one of the forms of pneumonia, both of which diseases have always appeared in greater or less force in large military organizations; also, under the support of the Rockefeller Foundation, Carrel, in conjunction with Dakin, had perfected, at Compeigne, France, a method of treating surgically infected wounds which had come to have wide applicability in practice. It seemed right and proper, therefore, that the Rockefeller Institute should employ its resources in men and facilities in the service of the Surgeon Generals of the Army and Navy in dealing with their large and important problems.

Meanwhile, the personnel of the institute suffered considerable depletion, as a considerable number of the scientific staff insisted on going into active service with the expeditionary force; but a nucleus of the staff was reserved, through cooperation with the Government, and indeed even augmented by special consignments made by the Surgeon General of the Army, in order that the particular service which the institute could render the Government might be carried out.

The war demonstration hospital of the Rockefeller Institute was planned as a school in which to teach military surgeons the principles of and art of applying the Carrel-Dakin treatment. The idea of a teaching hospital of this kind was conceived after the diplomatic break of this country with Germany occurred, and before war was actually declared against that country. It was also thought of as a model of a base hospital which might be studied by military authorities in the United States; and hence it was constructed on what was regarded as the best plan for such hospitals as developed on the Western Front. The hospital was essentially a portable structure, including two wards of 24 beds each and all the necessary subsidiary units. The unique feature was a large laboratory for teaching the technique of bacteriological control of the wounds, and for research on problems arising out of cases admitted or suggested by the general subject of wound infection.

In order to arrange for the admission to the hospital of wounded soldiers from overseas it was necessary for the war demonstration hospital to have an Army status. Therefore, on August 24, 1918, the hospital, in connection with the United States Auxiliary Laboratory No. 1, was reorganized as United States Army Auxiliary Hospital No. 1 and placed under the command of the port of embarkation, Hoboken, N. J., with a captain of the Medical Corps as commanding officer, a captain of the Sanitary Corps as adjutant, and a

sergeant of the Medical Department in charge of the sick and wounded records.¹⁰ No other change in the staff was made.

INSTRUCTION

Instruction was given to medical officers of the Army and Navy, to enlisted men in both services, to civilian surgeons, and to female nurses of the Red Cross and civil hospitals. The classes were conducted in the wards, in the operating room, and in the laboratory; and various devices were used to illustrate and enforce the teaching. The medical officers and others (e. g., chemists and bacteriologists) were taught the principles of the Carrel-Dakin method of the treatment of war wounds and were required to cover, by personal observation or operation, all the essential points involved in its proper application. They learned to prepare and to titrate the Dakin solution, to make microscopical examinations in the bacteriological laboratory, and to prepare the wound and apply the treatment in the operating room and at the bedside.

The course of instruction for medical officers covered ordinarily a period of two weeks. Two classes, therefore, were conducted each month. At first the patients were civilians suffering from a wide variety of infected wounds. After the American Army had begun active military operations in France and the wounded began to be returned to the United States, the soldiers suffering from infected war wounds displaced the civilians. The first overseas case was received on August 31, 1918. The first class reported for instruction on August 2, 1917, and the last class completed its work on March 29, 1919.

The following is a detailed account of the number of courses given, and the number of persons receiving instruction:

Number of courses given:		Number of persons receiving instruction—Continued.	
Surgical classes.....	41	Special instruction—Continued.	
Chemical ^c classes.....	6	Chemistry—	
Laboratory ^d classes.....	3	Medical officers and enlisted men of the Army.....	129
Total.....	50	Medical officers and enlisted men of the Navy.....	2
		Civilians.....	3
Number of persons receiving instruction:		Total.....	134
Regular class—		Laboratory—	
Medical officers of the Army.....	719	Medical officers and enlisted men of the Army.....	78
Medical officers of the Navy.....	88	Total receiving instruction..	1, 270
Civilians.....	53	Special demonstrations to groups:	
Total.....	860	Groups of surgeons of base hospitals..	12
Special instruction—		Surgical classes attending other schools of instruction in New York.....	10
Surgery—		Group of civil surgeons.....	1
Medical officers of the Army..	35	Groups of nurses of base hospitals..	35
Medical officers of the Navy..	11	Total.....	58
Enlisted men of the Army.....	30		
Enlisted men of the Navy.....	45		
Female nurses.....	27		
Civilians.....	50		
Total.....	198		

^c This course was organized on April 1, 1918. It consisted of three days' instruction in the chemistry of antiseptics.

^d This course was organized July 1, 1918. One week's instruction given in laboratory methods used in conjunction with treatment of wound infection.

The complete surgical course embraced the following three subjects: Surgical clinic; laboratory methods; chemistry of antiseptics. The following schedule outlines the complete course:

Complete surgical course

FIRST WEEK

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic
	10 to 12.15 Lecture room: and chemical laboratory: Antiseptics; Dakin solution	10 to 11 Surgical laboratory: Preparation of surgical dress- ing 11 to 12.15 (Half) Surgical laboratory: Tubes; dress- ings. (Half): Bacteriological laboratory: Smears	10 to 12.15 Chemical labora- tory: Antisep- tics (continued)	10 to 12.15 Chemical labora- tory: Preserva- tion of Dakin solution	10 to 11 Bacteriological laboratory: Action of anti- septics on bac- teria 11 to 12.15 Lecture room: Blood trans- fusions

12.15

Luncheon

2 Assembly, lecture room		2 to 3.30 (Half) Bacteriological laboratory (con- tinued). (Half): Surgical laboratory: Dressing; tubes	2 to 3.30 Central building, fourth floor: Resus- citation and other therapeutic methods	
2.30 Lecture room: General principles	2 to 5 Chemical laboratory (continued)			2 to 5 Chemical laboratory (continued)
3.30 Lecture room: Bacteri- ological smears		3.30 to 5 Application of appara- tus and dressings, surgical laboratory	3.30 to 4 Lecture room: Anes- thesia	

SECOND WEEK

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic	9 to 10 Clinic	
10 to 12.15 Bacteriological lab- oratory: Action of antiseptics on necrotic tissue and on dressing mate- rials	10 to 12.15 Chemical labora- tory: Effects of blood and tissue on antiseptics	10 to 11.30 Lecture room: Importance of mechanical cleansing	10 to 12.15 Lecture room and laboratory: Fractures	10 to 12.15 Chemical labora- tory	

11.30 to 12.15

Cicatriztion

Complete surgical course—Continued

12.15

Luncheon

2 to 5	2 to 5	2 to 3.30	2 to 3.30	1.15 to 2.30
		Lecture room: Tetanus	Lecture room: Gas infection	Chemical laboratory
Bacteriological laboratory: Antiseptics on blood, muscle, skin	Chemical effects of living tissue on antiseptics	3.40	3.30	3
		Bacteriological laboratory: Results	Chemical laboratory: Examination	Lecture room

In carrying out this schedule from the clinical side, ward rounds were made, operative and dressing clinics held, lantern slides and motion pictures shown to demonstrate the necessity for an exact method of treating infections and the importance of following the four essential principles of the Carrel-Dakin method—mechanical or surgical cleansing, chemical sterilization, bacteriological control, and closure. The routine of teaching followed is briefly summarized.

Mechanical cleansing.—Using careful surgical technique, the surrounding skin was cleansed. In some superficial wounds it was possible to sterilize by mechanical means, scrubbing with neutral soap and water being sufficient at times. In the more highly infected wounds, involving the deeper structures, it was not only necessary that the outside be cleansed, but that a thorough, careful surgical operation be performed. Faulty mechanical cleansing can lead to only one result—continued infection, with loss of function, or in many cases loss of life. It was impossible to teach men surgery and surgical judgment in the brief space of two weeks, but it was possible to emphasize the principles of thorough and careful preparation as to the stages of treatment, if the condition of the patient made this necessary.

Chemical sterilization.—Chemicals could not, of course, be expected to dissolve out and thus remove foreign bodies such as fragments of shell, clothing, bone, etc. The proper clinical use of the chlorine was demonstrated to the classes, and emphasis was laid on the point that in the employment of antiseptics the three cardinal principles of time, concentration, and contact must be observed at all times.

Control.—Observation with the eye alone would not tell the true condition of a wound. To assist in this work, two methods were available: The curve of cicatrization, and the bacteriological control by means of smears and cultures. The former was intended mainly for scientific purposes and not for everyday clinical use. It indicated what effect an antiseptic or method of treatment had upon the rate of growth of epithelium. For practical purposes, the bacteriological smear control of the wound was of greater value. If mechanical and chemical sterilization had been carried out properly, the bacterial count would fall. If there was a rise or irregularity, the cause was usually a fault in the mechanical cleansing or in the application of the antiseptic, rather than in the method itself.

Closure.—After the control had shown the wound to be sterile, it might be safely closed by any surgical procedure, such as a simple suture, fat transplant, skin flap, skin graft, or other method suited to the case.

The total number of cases admitted to the hospital during the periods of its active service was 325.

LECTURES AND DEMONSTRATIONS

Resuscitation.—The lectures on the methods of resuscitation consisted in an experimental demonstration on animals of the efficiency of the method of pharyngeal insufflation. The thorax of etherized or curarized dogs was either transversely split or the walls completely removed, thus exposing lungs and heart to full view of the entire class. Without the aid of artificial respiration the lungs, of course, collapsed and as a consequence the heart slowed up. Shortly after the heart stopped beating, pharyngeal insufflation was instituted, which caused immediately the rhythmical distention of the lungs, and the heart recovered, sometimes in less than one minute. The experiment was always a success and made a profound impression upon the classes.

Tetanus.—Regarding the treatment of tetanus, three points were discussed: (1) The removal of the primary cause by proper surgical methods; (2) the neutralization of the free toxin in the blood and the lymph by means of a thorough serum treatment; (3) the treatment of the tetanic manifestations after the toxin was once fixed in the nerve cells and thus was not amenable to the neutralizing action of the antiserum. Here chiefly the treatment by magnesium was indicated. The action of magnesium was demonstrated by actual experiments on tetanic dogs: (a) Animals in a severe and dangerous state of tetanus were relieved and restored to nearly normal within a few minutes by a judicious intravenous injection of magnesium sulphate; (b) in another experiment it was shown that an injudicious administration of the magnesium salt might endanger the animal's life; (c) it was finally shown that tetanic animals which received intentionally too much magnesium and thus were in imminent danger could be saved in a few minutes by an intravenous injection of a normal solution of calcium chloride. There were animals in which after receiving a very large dose of magnesium the respiration was completely abolished and the heart's action could not be felt any more; they were nevertheless resuscitated by means of calcium and with pharyngeal insufflation.

SPECIAL INVESTIGATIONS

A number of specific problems which arose in the course of the work of the hospital were studied and several papers published. The following observations were made: (1) It was found that hypochlorite solutions, even if neutral, have the ability to dissolve necrotic tissue, plasma clot, or exudate and pus cells, whence their power of "clearing" the wound and of more efficient bactericidal action, since the bacteria, otherwise protected by the débris or exudate, are readily exposed to the antiseptic effect of the hypochlorite. (2) The chlorine content of hypochlorite solutions diminished more rapidly when in contact with necrotic tissue than with intact normal tissue. On the other hand, chloramine-T solutions are not only more stable, but deteriorate a little

more rapidly in the presence of necrotic than of normal tissue. (3) Dakin's hypochlorite solutions and chloramine-T solutions quickly destroy the exotoxin (Bull) of *B. welchii*. (4) The following antiseptics were tested for poisonous effects on animals and showed decreasing toxicity in the order given: Eucalyptol, brilliant green, mercuraphen, mercuric chloride, chloramine-T, dichloramine-T, proflavine, hychlorite, Dakin's hypochlorite, javelle water, magnesium hypochlorite, iodine, phenol.

In addition to these main points, subsidiary ones to which some attention was given were studied. It was found that of the solutions of hypochlorites and allied chlorine compounds available for clinical use, none showed an appreciable solvent action on blood clot. Hence arose the advisability of proper mechanical cleansing and treatment of wounds, in order to remove and prevent blood clots which might harbor bacteria.

Beginning in August, 1918, instruction was given convalescent patients by aides in reconstruction and occupational therapy.

At the request of the Surgeon General of the Army, the courses in instruction for medical officers were continued until April 1, 1919. The last class completed its work on March 29, after which the patients remaining were evacuated as rapidly as possible and the hospital was closed on April 15, 1919.

UNITED STATES ARMY AUXILIARY LABORATORY NO. 1

The fact was early recognized, once we were at war, that the Surgeon General would make heavy demands upon the personnel of the bacteriological and clinical chemical laboratories of the country. It was thought probable that the existing highly-trained personnel would prove inadequate to meet the needs. On the other hand, it was believed that the recent general addition to the medical curriculum, of bacteriology and its handmaiden, serology, and the corresponding improvement in the teaching of chemistry in medical schools, as well as the creation of many diagnostic laboratories in hospitals, would provide a large number of partially-trained laboratory workers who could readily and quickly be prepared to carry out, either alone or under supervision, diagnostic work in camp laboratories. Other potential sources of workers were the schools of agriculture in which instruction in bacteriology was given. Hence it was proposed to establish training courses in bacteriology, serology, and (later) medical chemistry for this class of students. The Surgeon General approved the project, the laboratory was organized and the Surgeon General assigned medical officers and others to the Rockefeller Institute for instruction.

COURSE IN BACTERIOLOGY

The first requisite was a teaching laboratory. In view of what was stated of the nature of the institute, namely, an institution of pure research for already trained workers, no general instructional laboratory had ever been called for. Fortunately, a new laboratory building of the institute had been recently occupied and contained a large, undivided, and unoccupied space on a convenient floor which could be utilized. The necessary desks and apparatus were quickly assembled and installed, and the first course of instruction opened on June 25, 1917. The instruction covered a period of four weeks (28

days), and the course was repeated once a month. In July, 1918, one week's instruction in surgical bacteriology was added, and in the fall of 1918 one week was set aside for the study of anaerobes. Hence when the classes were discontinued, the instruction covered a period of six weeks. At the outset an arrangement was made for 20 places in the laboratory; later the number was increased to 53. Eligible persons were accepted from the Army and Navy, and when space was available a few civilians who proposed to enter the service were admitted. Eligibility consisted of previous training in laboratory methods, with special reference to bacteriology and serology (immunology).

The course of instruction was planned to be intensive and strictly practical, and to cover a selected set of subjects which it was believed would dominate the demands made on the diagnostic bacteriological laboratory. The work was practical, the student carrying out under the direction of instructors the entire series of operations which he would be called upon to perform in the diagnostic laboratory. A series of brief lectures and demonstrations was designated in order to make the object of the various steps clear to the student, and to connect the operation with the present state of our knowledge and to point out to him the readily accessible articles and books for his further guidance. The schedule which follows represents the subjects taught and the period given to each when the course had been fully developed. In order that the nature and manner of the instruction may be easily apprehended, the plan of instruction in a few of the main subjects is given in some detail.

FIRST WEEK—TYPHOID AND DYSENTERY

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
<p>9 to 10</p> <p>Lecture: Preparation and standardization of media</p>	<p>9 to 10</p> <p>Lecture: Diagnosis—blood, stool, urine, Widal, Dreyer curve, etc.</p>	<p>9 to 10</p> <p>Lecture: Prophylaxis; sanitation; vaccination, preparation of vaccine</p>	<p>9 to 10</p> <p>Lecture: Sanitary analysis of water</p>	<p>9 to 10</p> <p>Lecture: Preparation of immune serum for diagnosis. Serological reactions in experimental and clinical dysentery</p>	<p>9 to 10</p> <p>Lecture: Serum treatment of dysentery</p>
<p>10 to 12</p> <p>Laboratory: Preparation of endo, brilliant green, and sugar media</p>	<p>10 to 12</p> <p>Laboratory: Sugar reactions; fishing and identification of colonies; lead acetate double sugar; slide agglutination</p>	<p>10 to 12</p> <p>Laboratory: Preparation and standardization of vaccine</p>	<p>10 to 12</p> <p>Laboratory: Completion of unknown; bacteriological examination of water</p>	<p>10 to 12:30</p> <p>Laboratory: Examination of stools for <i>B. dysenteriae</i> and unknown culture. Continue culture examination of various types of <i>B. dysenteriae</i>. Agglutination tests with Shiga, Flexner, and polyvalent immune serum and types of different <i>B. dysenteriae</i> cultures.</p>	<p>10 to 11</p> <p>Practical: Completion of agglutination test, etc., for recognition of type of unknown culture and suspected stools</p>
<p>2 to 3</p> <p>Lecture: Characteristics of colon-typoid group</p>	<p>2 to 3</p> <p>Lecture: Epidemiology; water, food, insects, carriers</p>	<p>2 to 3</p> <p>Lecture: Treatment of typhoid</p>	<p>2 to 3:30</p> <p>Lecture: Classification of dysenteric bacilli. Rapid methods of isolation</p>	<p>2 to 3</p> <p>Lecture: Pathology of clinical and experimental dysentery. Differences between <i>B. dysenteriae</i> Shiga from Flexner group</p>	<p>11 to 12:30</p> <p>Lecture: Epidemiology and prophylaxis of dysentery; Army experiences</p>
<p>3 to 5</p> <p>Laboratory: Study of pure culture of colon-typoid and paratyphoid bacilli; colony growth; staining reactions; agglutination; inoculations in sugar media and Russell double sugar; plating of carrier stool</p>	<p>3 to 5</p> <p>Laboratory: Dreyer-Widal, unknown stool</p>	<p>3 to 5</p> <p>Laboratory: Examination of unknown plates, fishing colonies</p>	<p>3 to 5:30</p> <p>Practical: (a) Examination of suspected stool for <i>B. dysenteriae</i>. (b) Study of cultural characteristics of various types of <i>B. dysenteriae</i>. (c) Classification of a culture of a type of <i>B. dysenteriae</i> unknown to the student</p>	<p>3 to 5:30</p> <p>Practical: Injection of rabbits with culture for pathology. Continuation of practical work started previously</p>	<p>Reports on unknown cultures completed this afternoon or Sunday morning</p>

SECOND WEEK—PNEUMONIA ^a

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 Lecture: Biology of pneumococcus	9 to 10 Lectures: Biological classification	9 to 11 Laboratory: Sputum, Avery medium, streptococcus and pneumococcus	9 to 10 Laboratory: Mouse autopsy; study of unknown culture	9 to 10 Lecture: Epidemic influenza	9 to 10 Lecture: Serum treatment
10 to 12 Laboratory: Morphology, staining properties, bile solubility, agglutination, cultures	10 to 12 Laboratory: Fishing colonies, agglutination, mice autopsy	10 to 11 Lecture: Streptococcus 11 to 12 Laboratory continued	10 to 11 Lecture: Pathology—streptococcus and pneumococcus 11 to 12 Study of unknown cultures	10 to 12 Laboratory: Morphology, biology, and pathogenicity of <i>B. influenza</i> ; plating	10 to 12 Finish unknown: study plates of influenza; file report; quiz
2 to 3 Lecture: Type determination	2 to 3 Lecture: Laboratory aids in diagnosis	2 to 3 Lecture: Rapid methods of type determination and soluble substances	2 to 3 Lecture: Epidemiology	2 to 3 Lecture: Serum production and standardization	
3 to 5 Laboratory: Autopsy of inoculated mice; injection of sputum	3 to 5 Laboratory: Autopsy injected mice; plate unknown cultures	3 to 5 Autopsy mice; agglutination and precipitin; capsule stain; injection of sputum	3 to 5 Type determinations; sputum	3 to 5 Laboratory: Study of unknown cultures; type determination on urine	

^a After the outbreak of streptococcus pneumonia in the winter of 1917-18 in the cantonments, instruction on streptococcus was introduced into the course.

THIRD WEEK—MENINGITIS

9 to 10	9 to 10	9 to 10	9 to 10	9 to 10
Lecture: Biology of meningococcus	Laboratory: Autolysis	Laboratory: Making West and nasal swabs; study of Gram-negative diplococci	Lecture: Pathogenicity; clinical diagnosis	Lecture: Epidemiology
10 to 12	10 to 11	11 to 12	10 to 12	10 to 11
Laboratory: Morphology; staining cultures	Lecture: Autolysis, and production of monovalent sera	Lecture: Isolation of meningococci from nasopharynx	Laboratory: Complete test from preceding day. Begin work on "unknown" plates	Laboratory: "Unknown"
	11 to 12			11 to 12
	Injection of rabbits			Lecture: General considerations. Field methods
2 to 3	2 to 3	2 to 5	2 to 3	2 to 3
Lecture: Lumbar puncture, and examination of cerebro-spinal fluid	Lecture: Types of meningococci	Laboratory: Effect of sputum contamination; distribution of meningococci in the pharynx	Lecture: Preparation of therapeutic serum	Laboratory: Titration of monovalent sera; experiment—chemical versus serum treatment
3 to 5	3 to 5		3 to 5	4 to 5
Laboratory: Autolysis; cerebro-spinal fluids; isolation of organisms	Laboratory: Isolation of meningococci from nasopharynx; agglutination		Laboratory: Making plates; swabbing carriers; bleed rabbits	Meeting of institute staff
				Complete unknown and report. Finish Sunday morning if necessary

ANAEROBES^a—FOURTH WEEK

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 Lecture: General considerations; war wounds; preparation of media	9 to 10 Lecture: Rapid methods for identification of anaerobes from war wounds	9 to 10 Lecture: <i>V. septicæ</i>	9 to 10 Lecture: Soluble toxins—tetanus, botulismus, Welch bacillus	9 to 10 Lecture: Anaerobes of secondary importance— <i>B. sporangies</i> , <i>B. histolyticus</i> , <i>B. infernus</i> , <i>B. putrificus</i> , <i>B. fusiformis</i>	9 to 10 Lecture: Aerobic bacteria in wounds; method of obtaining specimens for examination; preservation of cultures
10 to 12 Laboratory: Examination of old cultures; morphology and cultural characteristics	10 to 12 Laboratory: Begin with identification of anaerobes from specimen	10 to 12 Laboratory: Study of the culture; continuation in identification of culture from the specimen	10 to 12 Laboratory: Demonstration of methods of filtration, and cultures; continue identification of cultures from specimen	10 to 12 Laboratory: Study of cultures; continue specimen examination	10 to 11 Laboratory: Report on specimens; practical examination 11 to 12 Reports of war experiences and discussion
2 to 3 Lecture: Methods and apparatus	2 to 3 Lecture: <i>B. welchii</i>	2 to 3 Lecture: <i>B. chauveaui</i> , <i>B. oedematis</i> , <i>B. bellonensis</i>	2 to 3 Lecture: Antitoxins (Rull and Pritchett, Weirberg and Seguin, etc.); polyvalent sera; antitoxic and antitubercular sera; serotherapy (vaccine therapy); prophylaxis	2 to 3 Lecture: Unusual anaerobes— <i>B. fallax</i> , <i>B. pseudotuberculosis</i> , <i>B. teres</i> , <i>B. atrofrigidus</i> ; anaerobic streptococci; gas gangrene	
3 to 5 Laboratory: Demonstrations of methods and technique	3 to 5 Laboratory: Study of culture, transplantation to differential media; injection of guinea pigs	3 to 5 Laboratory: Study of cultures	3 to 5 Laboratory: Neutralization experiments	3 to 5 Laboratory: Study of cultures; pathology of gas gangrene	

^a In the fall of 1918, the course was extended to include instruction in anaerobes. On account of the armistice and the discontinuation of the instruction, only one such course was given.

FIFTH WEEK—MISCELLANEOUS SUBJECTS

9 to 10	9 to 11	9 to 11	9 to 10:30	9 to 10	9:30 to 12
Lecture and demonstration: Intestinal parasites	Lecture: Classification of spirochetes	Laboratory: Dark field ex- aminations	Laboratory: Wassermann reaction	Lecture: Transfusion	Lecture and ward rounds, Willard Parker Hospital, for contagious diseases
10 to 12	11 to 12	11 to 12	10:30 to 12	10 to 12	
Laboratory: Intestinal parasites	Laboratory: Spirochetes	Lecture: Chemotherapy of syphilis	Lecture and demonstration: Pathology of poliomye- litis	Laboratory: Typing blood for transfusion	
2 to 3	2 to 3	2 to 3	2 to 3:30	2 to 3:30	
Lecture and demonstration: Malaria	Lecture: Syphilis	Lecture: Serological diagno- sis of syphilis	Laboratory: Pathology of poliomyelitis	Lecture: Poliomyelitis; epi- demiology and treatment of poliomyelitis	
3 to 5	3 to 5	3 to 5	3:30 to 5	3:30 to 4	
Laboratory: Malaria	Laboratory: Treponema pal- lidum	Wassermann reaction	Diagnosis of poliomyelitis	Lecture: Preparation of cow- pox vaccine and technic of vaccination	
				4 to 5	
				Meeting of institute staff	

SIXTH WEEK OF BACTERIOLOGY OF WOUNDS AND TECHNIC OF TREATMENT OF INFECTED WOUNDS

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9 to 10 Lecture: Principles of Carrel-Dakin method of treatment	9 to 10 Lecture: Bacteriological control of infected wounds			9 to 10 Surgical clinic: Results of treatment of infected wounds	9 to 10 Demonstration: Preparation of chloramine-T paste and neutral soap solution
10 to 11:30 Lecture and demonstration: Preparation and standardization of chlorine antiseptics	10 to 12:15 Laboratory: Enumeration of bacteria in films from infected wounds	9 to 12 Laboratory: Preparation of Dakin's solution	9 to 12 Laboratory: Solvent action of various antiseptics on surgical dressing material and on fibrin, pus, blood clots	10 to 12:15 Laboratory: Stability of chlorine antiseptics	10 Adjutant's office
11:30 to 1 Laboratory: Titration of chlorine antiseptics					
2 to 5 Laboratory: Preparation of Dakin's solution	2 to 3:30 Laboratory: Preparation of tubes used in Carrel-Dakin method 3:30 to 5 Lecture and demonstration: Apparatus used in treatment	2 to 5 Standardization of Dakin's solution	2 to 5 Demonstration: Action of chlorine antiseptics on the toxius of Welch bacillus	2 to 5 Laboratory: Experiments on decomposition of chlorine antiseptics and in the presence of organic matter	

^a In July, 1918, the period of instruction was extended to include 1 week at the war demonstration hospital of the institute, to receive instruction in the bacteriology of wounds and the technic of treatment of infected wounds.

Each class in bacteriology was sent for half a day to the Willard Parker Hospital, for instruction in the hospitalization of contagious diseases.

The number of persons receiving instruction in the courses in bacteriology was 480; they were distributed as follows:

Officers of the Army	382
Enlisted men of the Army	32
Officers of the Navy	44
Female technicians	4
Civilians	18
Total	480

COURSE IN CHEMISTRY

The course in clinical chemistry was begun April 1, 1918. At first it included only methods of use in clinical diagnosis, but later it was extended to include also the methods of sanitary chemistry which were most called for in the camps. A regular four-year university course in chemistry was required for entrance, with a few exceptions in the cases of Medical Reserve Corps officers sent by the Surgeon General. Part of the men had also completed post-graduate courses for higher degrees. Because the students selected were already familiar with general chemical technique, they were able to complete the following course in one month.

The course included quantitative and qualitative chemical analysis and microscopic examination of urine; quantitative analysis of blood for the determination of acetone, acetoacetic acid,* non-protein nitrogen, urea, chlorides, bicarbonate, oxygen, hemoglobin, and sugar; detection of blood in feces; analysis of gastric contents; functional tests of glucose tolerance in diabetes, bicarbonate retention in acidosis, and phenolsulphonephthalein test for kidney function; sanitary analysis of water, and qualitative tests for poisonous metals and alkaloids; the preparation and standardization of Dakin's solution.

Nine courses in all were given, and the following persons received this instruction:

Officers of the Army	44
Enlisted men of the Army	75
Civilians	7
Total	126

COURSES IN THE DIAGNOSIS AND TREATMENT OF PNEUMONIA

Soldiers suffering from pneumonia were admitted to the hospital of the Rockefeller Institute for treatment to as great an extent as the facilities permitted. The Surgeon General of the Army assigned medical officers to the hospital, where they were taught the methods of pneumonia diagnosis and treatment as perfected there. These officers lived in the hospital and served as internes; they remained for a period of six weeks to several months. After leaving the hospital, in many instances, they served in the pneumonia wards of camp base and general hospitals. The total number of medical officers assigned to this duty was 26. In May, 1918, as the number of pneumonia cases entering the hospital became very few, this instruction was largely transferred to Camp Jackson, S. C., where it was conducted under the direction of a medical officer who had previously been assisting in the work at the Rockefeller Institute.

COURSES FOR TECHNICIANS

Toward the end of the period during which instruction in bacteriology was given, the increasing requirement for technical aid in the Army laboratories suggested the advisability of training a certain number of women in the making of culture media and section cutting and staining. Hence classes were formed consisting of six women who spent two weeks in the preparation room of the institute, in which all the culture media were prepared, and two weeks in acquiring the technique of fixing, hardening, embedding, cutting, and staining of sections of tissue. Forty women availed themselves of this instruction. The course in media making covered the following operations:

Schedule of instruction for women technicians

FIRST WEEK

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
8 to 12 a. m. Practical work in preparation room; sterilizing infected glassware.	8 to 12 a. m. Practical: Cleansing pipettes.	8 to 12 a. m. Practical: Care of porous filters.	8 to 12 a. m. Practical: Wrapping Petri plates.	8 to 12 a. m. Practical: Plugging test tubes.	8 to 12 a. m. Practical: Flasks; special apparatus.
1 to 5 p. m. Practical: Cleaning laboratory glassware in large quantities.	1 to 5 p. m. Practical: Cleaning special glassware.	1 to 5 p. m. Practical: Sterilization methods; dry heat; autoclave; fractional.	1 to 5 p. m. Practical: Plugging and wrapping pipettes.	1 to 5 p. m. Practical: Agglutination tubes.	

SECOND WEEK

9 to 10 a. m. Lecture: Culture media.	9 to 12 a. m. Practical: Preparation of broth.	9 to 12 a. m. Practical: Sugar media.	9 to 12 a. m. Practical: Media for pneumococcus; buffer media.	9 to 12 a. m. Practical: Preparation of solutions used in media room.	9 to 12 a. m. Written examination.
10 to 11 a. m. Demonstration: Calorimetric method of hydrogenion determination.					
11 to 12 a. m. Practical: Titration of media.					
1 to 5 p. m. Practical: Titration.	1 to 5 p. m. Practical: Preparation of agar.	1 to 5 p. m. Practical: Double sugar media and Hiss' serum water.	1 to 5 p. m. Practical: Streptococcus.	1 to 5 p. m. Practical: Preparation of indicators.	

NONMILITARY INSTITUTIONS

SCHOOLS OF FRACTURES AND WAR SURGERY

Late in July, 1917, arrangements were completed whereby officers attached to the division of general surgery of the Surgeon General's Office were enabled to receive intensive instruction along various lines.¹¹ Beginning August 1, 1917,

at Rockefeller Institute (United States Army Auxiliary Hospital No. 1), as noted, the principle of wound healing and the treatment of wounds were demonstrated to classes of approximately 15 men, over a period of 2 weeks for each class. These classes of intensive instructions were made up of officers of the Medical Reserve Corps, men of surgical training, destined for future general surgical activity.

In October, 1917, courses of intensive instruction in the treatment of fractures were suggested:¹²

MEMORANDUM FOR THE SURGEON GENERAL

1. Permission is requested from the Surgeon General to inaugurate courses of intensive instruction in the treatment of fractures of from two to four weeks' duration, in the following cities: Chicago, Boston, Cleveland, Baltimore, Philadelphia, New York, Omaha, Denver, San Francisco, Pittsburgh. Arrangements will be made with clinical teachers who have large traumatic services which include many severe complicated fractures. Many prominent teachers have signified their willingness to cooperate in this work.

2. These courses of special instruction in fractures are for the benefit of a large group of well-qualified surgeons who have been actively engaged in the practice of general surgery during the past 10 years and whose services would be made more valuable if they could receive special instruction in the modern, efficient methods of treating fractures.

3. These courses are also greatly desired for many surgeons who earnestly wish active duty but who can not at present be assigned to training camps because their quota is complete. It is most desirable to keep these surgeons actively occupied in the service and this can be accomplished by assigning them to these courses of instruction, on the completion of which they may be assigned to cantonments, and in turn teach those who have not had the opportunity of receiving the special course of instruction.

(Signed)

WILLIAM H. MONCRIEF,
Lieutenant Colonel, Medical Corps.

Approved: By direction of the Surgeon General.

(Signed)

C. L. FURBUSH,

Major, Medical Reserve Corps.

About the time that these courses of instruction in fractures were being established it was realized that it was not practicable to give courses of instruction in fractures alone, because it was difficult to secure sufficient clinical material to take up the full time of the students, and besides, it was considered desirable to give instruction in the treatment of war wounds in connection with the treatment of fractures; therefore, the courses were arranged to embrace instruction in war surgery and fractures.¹¹

Arrangements were finally made for the establishment of courses, variously designated, in the following cities:¹¹ New York City (exclusive of Rockefeller Institute): Bellevue Hospital (2), Cornell University Medical College (1), Roosevelt Hospital (1). Boston, Mass.: Massachusetts General Hospital (1), Boston City Hospital (1). Philadelphia, Pa.: University of Pennsylvania (1). Pittsburgh, Pa.: Carnegie Building (1). Cleveland, Ohio: Lakeside Hospital (1). Chicago: Rush Medical College (1), Cook County Hospital (1), Presbyterian Hospital (1). New Orleans, La.: Charity Hospital (1). San Francisco, Calif.: Stanford University (1), University of California (1). Rochester, Minn.: Mayo Clinic (1).

The directors of the schools were prominent surgeons in the communities in which the schools were located and the teaching staffs were principally members of the staffs of the institutions in which the instruction was given.

An adjutant, and in some instances an assistant adjutant, was selected from the students by the director to assist in the keeping of records and the rendering of reports of the schools.¹³ At the completion of the courses the students were classified and a detailed report rendered to the Surgeon General showing the qualifications of each man. Weekly and monthly reports were also rendered showing the progress of the classes.

The first classes to be ordered to these schools were principally from the medical officers' training camps. Approximately 70 men were ordered from Fort Benjamin Harrison in November, 1917.¹³ The classes for January, 1918, were selected almost entirely from ambulance and field hospital companies, the idea being for these men to return to their organizations and act as instructors for other members of their units.¹³

The Surgeon General furnished to each school a set of standard splints, which had been adopted for general use in the Army, including a Bradford frame for each school.¹³

A syllabus of the abstracts of War Surgery was sent to each school by the Surgeon General, as indicated by the following circular letter which was used by all schools as a basis for the instruction given.¹⁴ The instruction, therefore, was basically the same in all schools except that at the Rockefeller Institute (q. v.) where the instruction was largely devoted to the treatment of wounds, and at the Mayo Clinic (q. v.) where the courses were along the lines of general surgery.

1. Under separate cover we are sending to you a syllabus containing abstracts of War Surgery. It is hoped that the material it contains may be of value to you and the surgical personnel.

2. Great care should be exercised to preserve this copy. You will acknowledge its receipt since they will be checked against you as part of the property sent for the course, and in case your class is taken over by some one this copy should go to the new instructor as part of the property of the Government.

The abstracts are primarily designed as a basis for the lectures, and the following are suggested as among the subjects which would be of interest to your class: (a) *War wounds*: The circular of November 1 contains an outline of this subject. Considerable emphasis should be placed upon (1) excision; (2) sepsis; (3) tetanus; (4) gas bacillus infection; (5) shock; (6) hemorrhage and aneurysm, primary and secondary; (7) ligation of vessels with a study of collateral circulation; (8) location of nerves (of importance because of excision of wounds). (b) *Wounds of special locations* (should have intensive study), e. g.: (1) Joints; (2) chest; (3) abdomen; (4) brain and spinal cord; (5) oral and neck surgery; (6) nerves. (c) *Amputations*: Form, site of election, especially after treatment. (d) *Fractures*. (e) *Burns and gas injury*.

3. If any further help can be given, communicate with this office, attention of the surgical division.

The following is a copy of a syllabus inclosed in the above letter and sent to the schools by the Surgeon General to aid in the teaching of the treatment of war wounds:¹⁴

THE TREATMENT OF WAR WOUNDS

(1) Arranged by the division of surgery, under authority of the Surgeon General, United States Army, for surgical teaching.

(2) In fighting pests apply antiseptic and protect wounds. Treat mortal complications only—do not scrub or explore.

(3) In front area: Don't suture wound! Don't scrub wound! Don't evacuate with tourniquet in place! Don't put on tight bandages! Don't probe!

(4) In front area: Do give antitetanic serum. Do arrest bleeding (a) by tying vessel, (b) by bandage over cone of gauze. N. B. Be sure circulation of limb is not cut off. Do apply splint to fractures without removing clothes.

(5) Antiseptics will cleanse wounds locally and control suppuration but will not affect bacteria after they have entered the circulation.

WOUND TREATMENT AT EVACUATION AND BASE HOSPITALS

(6) Exeision with foreign body removal and drainage when necessary are fundamental principles.

(7) If wound is excised within six hours immediate closure is often possible.

(8) Various other antiseptics have been used: Flavine, brilliant green, "Bipp," eusol, dichloramine-T., pierie acid, iodine, and many others.

(9) Eusol: A type of hypochlorous acid; is extensively used by the British. Probably less efficient than Dakin's solution.

(10) "Bipp"—Morison's method: Bismuth subnitrate, 1 ounce; iodoform, 2 ounces; paraffin, quantity sufficient to make paste. Excise and cleanse wound. Apply minimum amount "Bipp."

(11) "Bipp"—danger: Poisoning from bismuth or iodoform. Advantage: Little dressing of wound necessary.

(12) Hypertonic salt solution (Wright): Theory of use—osmosis from wound (lymphatic drainage), now little used by British.

(13) Flavine compound (Browning): Kills bacteria in wounds. Complete sterilization not so often secured. Fairly satisfactory but seems to inhibit repair after a time.

(14) Pierie acid: Five per cent pierie acid in alcohol—not so irritating as iodine and probably as efficient.

(15) *Closing of wounds.*—

First. Primary closing of a fresh wound after mechanical sterilization may be made if patient is afterwards closely watched.

Second. Secondary closing is made after mechanical and chemical sterilization and under bacteriological control. A wound may be sutured when surgical asepsis is obtained (1 bacterium per 5 fields).

(16) To-day suppuration of wounds can be surely prevented or stopped. There must be no pus in a hospital.

(17) Most of the amputations due to infection can be avoided.

(18) Septicemia generally can be prevented. The length of treatment of each wound can be reduced to one-third of what it is at present.

(19) These results can not be obtained without precise technique. No chemical substance has the power, by itself, to sterilize a wound, if proper surgical treatment is not applied.

(20) *Burns.*—Arranged by the division of surgery under authority of the Surgeon General, United States Army, for surgical teaching.

(21) Burns are treated by the following approved methods: Paraffin wax, open air, under bed tent, adhesive plaster, strapping, dichloramine-T.

(22) Do not scrub burns or apply antiseptics to them; scrubbing and antiseptics destroy essential epithelium.

(23) Fundamental principles underlying treatment of burns are: Asepsis, protection, conservation of epithelium, prevention and treatment of shock.

(24) Paraffin wax is combined with various ingredients and marketed under the trade names: Cerelene, ambrine, parresine, radintol, standlind, etc.

(25) Paraffin wax must be anhydrous. Guard against the boiling water of the water bath mixing with it.

(26) Paraffin wax is prepared acid free with or without addition of mild drugs.

(27) Paraffin wax should be solid when cold, and fluid at 140° F.; heating at 250° F. for 10 minutes renders aseptic.

(28) Paraffin wax furnishes favorable conditions for repair by acting mechanically as a protective.

(29) Burns of first degree should have open-air treatment. One application of paraffin or oil may be made at first dressing.

(30) Application by atomizer is safest and best method of avoiding pain. If brush is used wax must not be over 150° F.

(31) Puncture blebs. Preserve overlying epithelium. Dry thoroughly with gauze, pledgets, or dry air. Apply dressing rapidly while wax is liquid.

(32) Apply layer of wax, then layers of cotton and wax alternately. Avoid direct contact of cotton with burn, which causes pain in applying and removing. At subsequent dressings, wound may be washed with saline solution or weak antiseptic applied as spray; do not rub with cotton or gauze.

(33) Dressing changed once daily. Fetid odor is of no serious import and disappears rapidly under proper aseptic treatment.

(34) Clinical evidence of toxic absorption requires use of hot moist dressings (aseptic or antiseptic); do not use wax dressings under such circumstances.

(35) Burns in neighborhood of joints should be treated with the idea of preserving joint function. Beware of contractures.

(36) If large areas are denuded of epithelium, prevent scar tissue contraction by skin grafting.

(37) Burned fingers and toes will web permanently unless separated by gauze during healing.

(38) Burns may be treated by open method, exposed to air and protected only by gauze-covered wire frame.

(39) Treatment of burns by dichloramine-T.

The following syllabus of instruction in the standard methods for treating fractures was also sent to all the schools:¹⁵

The purpose of this course of instruction is to familiarize medical officers with standard methods in the treatment of fractures. It is intended that officers so trained will not only serve in the special fracture hospital, but in field, base, and general hospitals, and as regimental officers as well, so that a continuity in the methods for treating fractures can be maintained. By this means it is proposed to establish team work on the part of medical officers throughout the Army, in order that the wounded soldier will receive promptly the most efficient treatment, whether at the regimental aid station, the dressing station, the field hospital, the evacuation hospital, or the base hospital, as well as along the lines of transportation. The logical result of this cooperation will be to secure early recovery, lessen deformity, and reduce the number of soldiers permanently disabled to a minimum. It is realized that the exigencies of the service in the zone of the advance will frequently be such as to render the standard aids impracticable, but by indicating clearly the desideratum it is hoped that the difficulties in the field will act not so much as an obstacle, as a stimulus to the ingenuity of the medical officers.

Fractures in war are usually compound and will be much more prevalent than the simple, so that any treatment which considers merely the fracture and not the wound and the soldier would be quite ineffective. Consequently, the course of instruction will be initiated with a brief but thorough presentation of wounds, from a military standpoint, their causes, and their treatment. This will be followed by the course in standard methods for treating fractures proper. The instruction will be intensely practical in nature, consisting in the demonstration of the splints, their adaptability and application, and in clinics.

Causes and varieties of wounds:

1. Bullet wounds: (a) Shrapnel, (b) rifle, (c) pistol.
2. Shell wounds: (a) Shell fragments, (b) shell fuse, (c) hand grenade.
3. Bayonet wound, sword wound.
4. Burns.
5. Gas.
6. Varieties of wounds: (a) Abrasion, (b) contusion, (c) laceration, (d) puncture—complete or incomplete.

Condition of wounded men:

1. Hemorrhage, excessive (shock).
2. Exposure, wet, cold; hunger.
3. Shell shock.
4. Gas.
5. Visceral injury; abdominal, thoracic, and head.
6. Infection; pyogenic, tetanus, gas bacillus.
7. Suppuration.

Treatment:

General—

1. Water administered: (a) Mouth, (b) rectum, (c) hypodermoclysis, (d) intravenous, dangers.
2. Food and hot drinks.
3. Medication.

Local—

1. Wound antisepsis: (a) Excision, necrotic tissue; (b) wound cleansing; foreign body removal; (c) tincture of iodine, (d) Dakin-Carrel method, (e) dichloramin-T.
2. Hemorrhage: (a) Pressure by bandage, cautious; (b) packed, cautious; (c) tourniquet, cautious; (d) ligation of artery, cautious; (e) amputation, indications.
3. Dressings: (a) Dry antiseptic gauze, (b) suture; indications.
4. Infection: (a) Suppuration, (b) gangrene, (c) drainage.

Fractures (at the dressing station):

1. General treatment.
2. Wound antiseptic; 2 per cent iodine, superficial.
3. Wound cleansing.
4. Immobilization and extension methods—
 - I. Fractures of the upper extremity: (a) Simplest splint, arm to chest; (b) screen wire and wood splints; (c) if practicable, Thomas arm splint; elbow splint.
 - II. Fractures of the lower extremity: (a) Rifle down the side of leg with coat between legs, and then lashed together; (b) screen wire and wooden splints, (c) femur, Thomas knee splint for fracture of femur; in fracture of femur, the soldier once placed on litter is not to be removed therefrom.
 - III. Fracture of rib; immobilization.
 - IV. Fracture of pelvis, fixation; not removed from litter.
 - V. Joints.
5. Infection; special treatment: (a) Tetanus-serum, (b) Gas bacillus, seration; anti-toxin; (c) pyogenic.
6. Amputations, contraindications; indications.
7. Anesthesia.
8. Diagnosis tags. These must be kept up to date, particularly with fractures.

Transportation:

1. Cases sorted into transportable and nontransportable.
2. Maintenance of immobilization and extension, where practicable, methods. Not more than 12 hours should elapse without the splint being inspected by a surgeon, and necessary adjustments made.
3. Femur, special treatment for fractures of, in transit: Not to be removed from litter; Thomas knee splint inspected once every 12 hours.

Evacuation hospital, special fracture hospital, base hospital:

1. Early and adequate surgery.
2. Wound antisepsis.
3. Wound cleansing.
4. Conservation of fragments.

Evacuation hospital, special fracture hospital, base hospital—Continued.

5. Immobilization and extension; standard methods.

I. Fracture of upper extremity: (a) Humerus, (1) Jones humerus extension splint, (2) Jones abduction splint; (b) elbow splint, (c) radius and ulna, Jones forearm and wrist splint.

II. Fracture of lower extremity: (a) Femur, Thomas knee splint; Hodgen splint overhead suspension and extension from Balkan frame, or on special fracture bed; (b) tibia and fibula, Jones leg splint and Cabot splint.

III. Fracture of rib; immobilization.

IV. Fracture of pelvis; fixation; Bradford frame.

V. Joints; operative indications; foreign body removal; drainage.

6. Malunion and nonunion—caution—late tetanus and infection.

7. Infections; special treatment.

8. Operative treatment—indications for; standard methods.

9. Amputation; special.

10. Anesthesia; ether, drop method, chloroform; nitrous oxide; spinal, tropococaine.

11. Examinations, special methods: (a) Roentgen-ray, (b) bacteriological.

12. Massage and baking.

13. Hydrotherapy.

14. Curative workshop—reconstruction.

The number of officers given instruction by these institutions in these subjects up to the signing of the armistice was 1,195,¹⁶ exclusive of those given instruction at the Rockefeller Institute and at the Mayo Clinic.

As an example of the courses of instruction given at these institutions, an abstract of the history of the instruction given at Cornell University is presented.

CORNELL UNIVERSITY MEDICAL COLLEGE, NEW YORK CITY^e

The course of instruction in fractures and war surgery followed by Cornell University Medical College was planned to give a practical working knowledge of fractures and their complicating wounds as seen in military practice. With this in view, the first two weeks, and to a less extent the third week, were occupied for a considerable part of the time with the study of basic subjects, such as anatomy, chemistry, bacteriology, and pathology, an understanding of which was essential. These were taught entirely in the laboratories, and officers took an active part in the demonstrations. The balance of the time in these weeks, and the entire fourth week, was given over to clinical study in the hospital wards and operating room. In this way, the relation between the lectures and the laboratory work, on the one hand, and the practical application of facts thus studied to wounds and fractures, on the other hand, was presented throughout the course, and received more emphasis as the course advanced. It will be seen on examining the schedule of exercises that the entire course was based upon practical work, and that didactic instruction was minimized.

The college library, on the fourth floor of the college building, was open at all hours. It was well supplied with current and textbook literature on all the subjects discussed in the course. The library of the New York Academy of Medicine was open throughout the day and evening to all medical officers. Ample facilities were thus available for the necessary supplementary reading.

^e The statements of fact appearing herein are based on: "Cornell University Medical College Course of Instruction on Fractures and War Surgery for Officers of the Medical Reserve Corps." Copy on file, Historical Division, Surgeon General's Office.

CHEMISTRY

SUMMARY OF LECTURES AND LABORATORY DEMONSTRATIONS

1. Considerations of general properties, methods of use, mode of action, stability, etc., of the more common antiseptics.

The discussion includes:

a. Inorganic antiseptics:

Hydrogen peroxide.
Potassium permanganate.
Heavy metals—
Mercury.
Silver.
Halogens—
Iodine.
Hypochlorites.
Eupad.
Eusol.
Boric acid.

b. Organic antiseptics:

Alcohol.
Aldehydes—
Formaldehyde.
Paraform.
Halogen derivatives—
Iodoform.
Chloramine-T.
Dichloramine-T.
Phenols—
Carbolic acid.
Lysol.

2. Detailed consideration of recent halogen antiseptics, with special reference to Dakin's solution and the chloramine derivatives. The discussion includes common names of substances used, methods of preparation, calculations involved in correcting Dakin's solution,^f stability, products formed on decomposition, etc.

* * * * *

BACTERIOLOGY OF WOUND INFECTIONS

GENERAL CONSIDERATIONS

Influence of type of wound on infection.

Punctured, shattered, superficial, punched-out wound.

Probabilities of infection.

Sources of infection.

Direct—projectile, bayonet; material carried into wound; clothing, splinters, skin fragments, etc.

Indirect—earth and feces.

Subsequent infection.

Influence of dressings—(a) transmission of infection from skin; (b) on anaerobes.

Character of infection usually found; reasons.

Bacteriological analyses of clothing (chart).

New, soiled, and sterilized clothing.

Local mechanical conditions in wound affecting infection.

(a) Destruction of tissue; (b) interference with blood supply.

General body conditions affecting infection.

(a) Health; (b) age; (c) degenerative factors; (d) shock; (e) bleeding; (f) fatigue.

Physiological processes in wounds and effect on infection.

Differences in punctured and shattered types.

Influence of unaltered serum and lymph on bacteria.

Influence of altered serum and lymph on bacteria.

Influence of living and dead leucocytes on bacteria; on serum and lymph.

Influence of the presence of dead tissue.

(a) On growth of organisms; (b) on production of deleterious products.

^f At the time the course was given, Dakin's solution was prepared from bleaching powder, but a demonstration of its preparation from chlorine gas and also from common salt was included. A description of the preparation and action of this solution may be found in Vol. XI, pt. 2, p. 201 et seq., of this history.

Reaction that usually takes place in wounds.

Up to fifth hour, no reaction; microscopic findings.

Fifth to ninth hour, reaction begins; migrating elements; degeneration of injured tissues.

Ninth to twelfth hour, appearance of bacteria; anaerobes near bits of clothing.

Twelve hours, bacteria multiply and spread; some phagocytes appear; small amount of pus appears.

Twentieth to thirtieth hour, pus more abundant and fetid.

Forty-eight hours, anaerobes associated with aerobes.

Flora of wounds; stages (chart); types present in first stage.

General activities and dangers.

Distribution in wound; Wright's wet leech; streptococcus in wall.

Types of organisms taking part in chronic infections.

Persistence of anaerobic types; relation to dressings.

Relative unimportance of staphylococcus infection; source.

Contributing factors influencing type of infection.

Mechanical influence of oxygen and blood supply and food conditions; viability of tissues.

Symbiotic growth; anaerobic and facultative anaerobic putrefactive organisms.

Various pathogenic organisms; favorable and unfavorable effect.

Practical.

Methods of making films from wounds for bacteriological examination; stains employed and methods of staining.

Examination of stained films and methods of checking up the Carrel-Dakin treatment

B. AEROGENES CAPSULATUS (B. PERFRINGENS)

Group; occurrence in nature; faecal Bælinæa; morphological description.

Pathogenicity; causative relation to gas gangrene; charts and citations.

Food supply; dead tissue, muscle, glycogen; anaerobiosis.

Staining qualities in body and in cultures; capsule formation.

Spores; in feces and dirt; in wounds; in cultures; size, shape, position in bacterial body, and resistance.

Cultural description with exhibition of cultures.

Influence of foreign bodies in growth (cloth, metal).

Method of isolation (sources of error).

Symbiotic growth; charts and citations.

Production of poisonous products of growth; necessary factors; previous failures and Bull's method; effect of toxic products; local; general; on growth of organisms in tissue; antisera, Bull's; neutralizing value against toxic products; therapeutic value, prophylactic and curative; against toxic products; against growth of organisms; antisera, Weinberg.

Natural references of body against this organism.

Methods of increasing; active and passive immunization.

Logical methods of combating this infection.

Prophylactic; curative.

Practical: Staining and examination of materials from wounds and cultures.

B. MALIGNANT EDEMA (VIBRION SEPTIQUE)

Group; occurrence in nature; general description; pathogenicity; occurrence in gas gangrene; nature of lesions; food supply; anaerobiosis; staining qualities; motility, flagella; spores, size, shape, position in bacterial body, resistance; cultural description with exhibition of cultures; other organisms resembling; methods of differentiation.

Production of poisonous growth products; Bargue and Doli, Weinberg, Roux; nature and effect; production of putrefactive substances.

Antisera, Weinberg; symbiosis in war wounds.

Practical: Examination of films and hanging drop preparation.

B. TETANI

Group; general description; occurrence in war wounds; incidence.
 Morphology; staining qualities; motility, flagella; spores; pathogenicity; causation; presence without symptoms; retention in wounds over long periods; cryptogenic infections; effect of injection of washed spores.
 Cultural description with exhibition of cultures.
 Recognition in films; distinction from tetanuslike organisms.
 Toxin production; method.
 Toxin; strength; mode of action; path of entry; reasons for failure of cures with antisera.
 Antitoxin; use; methods; prophylactic; curative; chart of English results.
 Practical: Examination of films for recognition of; examination of films; of hanging drops for motility.

OTHER ORGANISMS PRESENT REQUIRING ANAEROBIC CONDITIONS

B. fallax of Weinberg. Short description; activities; percentage of incidence.
B. edematiens of Weinberg. Short description; activities; percentage of incidence.
Cocur jaune of Weinberg. Short description; activities; percentage of incidence.
B. sporogenes. Short description; activities; percentage of incidence.
Bacillus X of Fleming. Short description; activities.
Bacillus Y of Fleming. Short description; activities.
Bacillus "Hibler IX" of Robertson. Short description; activities.
 Anaerobic streptococcus.

STREPTOCOCCUS

Types of this organism causing infection.
Streptococcus hemolyticus.
Streptococcus viridans.
 Type causing wound infection; enterococcus; description.
 Special importance of streptococcus in wounds; growth in granulation tissue and unaltered serum.
 Types of primary and secondary infection caused by streptococcus.
 Pathogenicity of various types.
 Interrelationship; immunological—protective, agglutins.
 Morphological description.
 Capsulation.
 Staining qualities.
 Cultural description with exhibition of cultures.
 Products of streptococcal growth—toxins, hemolysins.
 Discussion of body defenses—bacteriolysins, opsonins.
 Immune sera.
 Use of vaccines; favorable and unfavorable conditions.
 Practical: Examination of films.

STAPHYLOCOCCUS

General description with habitat.
 Occurrence in nature.
 Relative importance.
 Varieties present in wounds; source.
 Relative pathogenicity of varieties.
 Pathogenicity.
 Cultural description with exhibition of cultures.
 Products of growth—hemolysins (soluble and fixed), leucocytic, leucase, gelatinase, proteolytic, depressing factors.
 Discussion of body defenses and use of vaccines.
 Practical: Examination of films.

GENERAL DISCUSSION OF OTHER ORGANISMS FOUND IN WOUNDS AND THEIR IMPORTANCE

Colon group.
 Proteus group.
 Pyocyaneus.
 Diphtheroids.

GENERAL RÉSUMÉ OF WHOLE SUBJECT OF WOUNDS

Discussion of sterilization of wounds—mechanical, physiological, chemical.
 Discussion of subject of disinfectants as applied to wounds, with exhibition tests.
 Practical: Examination of films to check Carrel-Dakin method.

PNEUMOCOCCUS

Group; morphology and staining reactions; pathogenicity; types with mortality statistics; types, recognition; technique, usual method, demonstration; technique, Mitchell method, demonstration; cultural reactions, exhibition; serum treatment.

MENINGOCOCCUS

(Same presentation as pneumococcus.)

COURSE IN PATHOLOGY OF BONES AND WOUND INFECTION

GENERAL DISEASES OF BONE

1. *Simple osteoporosis*.—(a) Best example is absorption of bone by cancer metastasis. Here bone is passively absorbed without cellular reaction, without cell ferment action, by pressure on bone, on vessels, and by local and general abstraction of nutriment. Spontaneous regression of cancer followed by spontaneous replacement of bone and healing of fractures. Gross and microscopic specimens.

(b) Simple osteoporosis also occurs as a spontaneous disease of adult bone without known cause; may be progressive, and local or universal. Cause, general malnutrition, or local disturbance of circulation.

(c) Osteoporosis occurs in various combinations in many other diseases of bone; e. g., tubercle. Gross and microscopic specimens.

Look out for preexistent osteoporosis in all adult subjects.

(d) Exhibition of humerus in case of universal extreme osteoporosis, practically no bone being left in skeleton. Senile marantic atrophy.

2. *Osteomalacia*.—Gestational; senile; infantile; local; universal; pure or associated with other bone changes.

Gross effects are softening, bending, deformities. Progressive, but with usual definite limit. Peculiar constitutional disturbance in nutrition of formed bone. General cause is failure of calcium metabolism in general malnutrition, to which contribute excessive demands of fetus, calcium deficiency in diet, and probably originally defective bone.

Microscopic: Soft, rounded bone trabeculae, deficient in calcium, basic staining, with strie of mucinous material, lacunar absorption. May be associated with much churning up of bone, new imperfect bone replacing old. Picture more or less specific.

3. *Osteitis fibrosa*.—Progressive disturbance of bone, with absorption and then excessive replacement by poorly ossified bone, with growth of soft, fibrous tissue throughout marrow. Tendency to form cysts in marrow.

Gross: Great thickening and softening of bone, which becomes chalky, cuts easily, bends, and breaks; skull first, long bones later; may be localized anywhere. Exhibition of three skulls.

Microscopic: Shows broad trabeculae of poorly ossified bone, some absorbing, others actively growing; may resemble osteomalacia; soft cellular, fibrous, vascular, marrow tissue; great reduction in red marrow; indirect sequels, bone cysts, benign giant cell sarcoma, fractures, and deformities.

4. *Rickets, congenital*.—Infantile forms. A constitutional nutritional disorder, with general anemia, and special defect of bone ossification, strictly connected with deficient calcium absorption and appropriation. Experimentally produced by calcium poor diet.

Gross: Overactivity of epiphyseal ends, with swelling of ends of bone, but poor ossification; pigeon breast; rosary; deformities; frequent unabsorbed islands of cartilage in marrow cavities; great irregularity of chalky ossification zones; exhibition of skeletons; anemia, marasmus, enteritis.

Microscopic: Overgrowth of cartilage with poor absorption; failure of periosteal bone; hyperemia.

5. *Syphilis, congenital*.—Interferes with growth of long bones; characteristic saw-tooth line of ossification; large liver, large spleen; early death of fetus, or dwarfing.

Acquired; necessity of requiring spirochaeta and not relying on Wassermann. In general affects periosteum and causes thickening of bone shaft and narrowing of medulla. Circumscribed areas of absorption may be associated, but less common. Exhibition of honeycombed skull. Look out for confusion with multiple myeloma. Often gives gummatous infiltration of muscles and soft parts. Exhibition of forearm, amputated for tubercle, which never thickens shaft.

Gummatous periostitis and osteitis not common, may result in much thickening and coarse honeycombing of entire shafts or of circumscribed portions of shaft; caries sicca; dry specimens.

Microscopic: Syphilitic granuloma, in periosteum, bone, or marrow; bone growth predominating over loss.

No excuse for amputating syphilitic limbs.

6. *Tubercle*.—Differs from lues in affecting chiefly joint surfaces and ends, always causing absorption, almost never growth; early involving soft parts, and giving much exudate, hyperemia, wide suppurating tracts and sinuses; very wide superficial skin invasion in late stages; hectic fever, anemia, emaciation; usually many tubercle bacilli in pus.

Microscopic: Typical; exhibition of gross specimens, wet and dry.

7. *Rheumatism, rheumatoid arthritis, gouty arthritis*.—All due to underlying metabolic disorder sometimes associated with low grade of bacterial (streptococcus) infection. Miscellaneous bacterial infections of low grade or chronic course may contribute.

All tend to produce chronic, progressive, productive periostitis about joints, with productive peri-arthritis. General results are absorption of joint surfaces, eburnation, osteophytes, stiffening of joints, partial ankylosis, complete ankylosis. Affects any or all joints of spine, chiefly large joints. Exhibition of gross specimens.

TUMORS OF BONE

Osteoma is comparatively rare, occurs chiefly in bones of skull, is of slow growth, and little present interest.

Exostoses occur at ends of long bones, show central core of cancellous tissue with marrow, are often covered with cartilage derived from joint surfaces, and slowly growing. Two gross specimens.

Osteophytes occur at ends of bones, along tendon and muscle insertions, are elongated, pointed, solid bone, and of inflammatory or traumatic origin.

Angioma occurs spontaneously, and follows trauma or fractures as a disturbance of healing process. Type cavernous. Two cases, one following trauma to head of humerus, giving massive enlargement, recurring once after curettage. One case spontaneous, in body of lumbar vertebra, causing absorption and collapse of spine with paraplegia.

Angioendothelioma.—A malignant, rapidly growing tumor arising in bone shaft or marrow cavity, absorbing bone and invading soft parts, with metastases. Not osteogenic. Structure resembles hypernephroma (adenocarcinoma of kidney), with blood spaces lined by high cylindrical cells with clear cytoplasm, and requiring separation from hypernephroma, by search for primary renal (or adrenal) tumor. Gross specimen from lower end of humerus.

Osteogenic sarcoma.—A specific disease of bone, always essentially the same, but occurring in three main gross forms:

1. Spindle cell, fibrous, or cellular periosteal sarcoma, shaft long preserved, grows to large size slowly, produces metastases, and is usually fatal. Several gross specimens, early and late.

2. *Telangiectatic osteogenic sarcoma*.—Very vascular, most vascular forms producing malignant bone aneurisms (gross specimen from humerus). Destroys shaft early, invades soft parts as vascular, cystic, pulsating tumor in which new bone is scanty but present. Rapid course, early metastases, practically always fatal. Operated on frequently after occurrence of pulmonary metastases. Always X ray the lungs. Ten gross specimens.

3. *Sclerosing osteogenic sarcoma* produces ivorylike bone filling marrow cavity and thickening shaft. Pure and very slow, but often associated with vascular or cellular sarcoma. Very malignant. Specimens.

Bone sarcoma affects chiefly ends of long bones arising centrally from epiphyseal line, and rather seldom invading joints. Specimens.

Metastases pass readily through blood vessels, enter lungs, and grow to large bulk. Two cases.

Benign giant cell sarcoma.—Medullary or central sarcoma or sareoid. A specific disease of bone marrow, usually associated and sequel of osteitis fibrosa, arising in cysts of this disease; often multiple, slow, without cachexia, never producing metastases; rarely breaking into joints. Absorbs bone shaft slowly but often steadily, sometimes with advancing bony capsule, which may crepitate. Structure shows typical cellular vascular granulation tissue in which are many large giant cells with very many small separate nuclei, quite different from giant cells of malignant sarcoma. This same structure may be acquired in the sinuses leading to malignant sarcoma. Treatment conservative. Gross and microscopic specimens.

Multiple myeloma.—A characteristic disease of bone marrow, consisting of a very mild or very malignant neoplastic growth of marrow cells. Usually chronic, multiple, with numerous perforating tumors of ribs, skull, sternum, spine, or long bones. Early signs are boring pains, X-ray picture, and Bence-Jones albuminuria.

Four main types.—(1) Plasma cell tumors. Typical plasma cells, usual show type may be mixed with myxoma. Prognosis bad. Two cases.

(2) Lymphocytoma. Small lymphocytes. May involve whole of long bone and be mistaken for very malignant "round-cell sarcoma." Case involving whole of humerus, recovering under X ray.

(3) Malignant large cell types. Large round cells, probably derivatives of granular leucocytes. Produces metastases and bulky tumors.

(4) Erythroblastoma. Rare. Small round cells with dense nuclei; malignant. Cells contain much or little hemoglobin. One case.

Myeloma thus varies widely in prognosis and should be distinguished from osteogenic sarcoma.

Exhibition of case developing three months after fracture of clavicle.

FRACTURES

Types.—Complete; green-stick; linear; chipping; perforation; impacted; comminuted. With dislocation. Determined by type of trauma and character of bone injured. Illustrative specimens.

Fate of fragments.—Favorable when periosteum, endosteum, and nutrition are intact. Bridges of periosteum may suffice. Usually necessary to remove all small loose fragments, leaving periosteum.

Fate of bone transplants.—Depends on age of subject. Most favorable when periosteum and endosteum are transferred. Bone and periosteum may suffice. Bone alone probably always absorbed. New vessels penetrate old Haversian canals and seem to keep alive the transplant, but there is nearly always gradual absorption and replacement by new bone.

Microscopic section (B. Brooks, A. S., 65, 66).

Healing of fracture.—Blood clot soon organized by fibroblasts and endothelium, forming a central cavity about ends which gradually shrinks in one to two weeks. General reactive process affects periosteal tissues, fascia, muscle over a wide area. Much new cartilage promptly laid down from all these sources, giving fusiform provisional callus. Extremely active growth of bone trabeculae throughout callus, with calcification and absorption of cartilage, giving definitive callus. Condensation of bony callus follows gradually, with firm

bone always somewhat excessive. Usually reopening of marrow cavity early filled with callus. Osteoporosis affects ends to variable, usually considerable degree, sometimes excessive with marked shortening.

Specimens illustrating excessive provisional callus at two weeks and later. Structure approaches that of osteogenic sarcoma.

Nonunion.—Chief cause is lack of osteogenic momentum, or excessive osteoporosis. Usually attended by failure to absorb cartilage which may remain surrounding a central cavity. Suppuration, common. Syphilis a rare factor. Wide stripping of periosteum may figure. Results: Fibrous union, or no union, or pseudoarthrosis. Dry specimens of each. Inclusion of muscle, or nerves may occur.

Complications of fractures.—Injury to muscles—widespread in military work. Forward, wavy, spiral movement of high-velocity projectiles. Wide contusion and killing of tissues due to hydraulic laws. Wide dissemination of fragments. Necessary to remove all loose fragments and all contused tissue in which circulation fails.

Injury to nerves and brain, a special topic.

Injury to vessels; arteries highly resistant. Rupture leads to gangrene. Partial integrity followed by thrombosis, secondary sloughing, and hemorrhage. Traumatic aneurism.

Infection.—Practically constant in compound fractures; bacterial content of clothing and dirt; open treatment; importance of blood masses; course of hemorrhage along fasciæ and within muscle sheaths; effects of suppurative osteomyelitis, with involucrum about old fractures (many specimens). Dead bone as harbinger of bacteria. (K. Taylor, A. S., 66, 522.)

ACUTE INFECTIOUS PERIOSTITIS, OSTEOMYELITIS, AND OSTEITIS

Modes of infection.—(a) Metastatic from abscess in distant area, during septicemic, infectious diseases, scarlet, variola, typhoid, etc.; (b) pyemic, from septic emboli; (c) direct infection, in compound fractures.

Bacteria.—Staphylococcus, commonest agent; produces abundant suppuration; tends to involve whole of marrow with large sequestra. Streptococcus, tends to affect epiphyses and joints, or periosteum, with less pus, and more necrosis. Typhoid gives late, localized cortical infection, little pus, seldom bulky sequestra.

Blood supply of long bones.—Three groups: Epiphyseal, from joint vessels; metaphyseal, from periosteum supplying ends of shafts (these two sets are end arteries); central nutrient artery supplying most of shaft. Experimental osteomyelitis shows dominance of these sets of vessels.

Gross pathology.—(a) Periostitis: Serous, fibrinous, or phlegmonous exudate gathers between bone and periosteum, strips up periosteum for short distance, gives localized abscess, and superficial necrosis of bone. Or entire shaft is affected with soft parts with fatal pyemia. Or marrow is penetrated through Haversian canals, marrow filled with localized or diffuse purulent exudate, leading to total necrosis of shaft. Pus beneath periosteum usually means pus in marrow cavity and calls for opening marrow.

(b) Osteomyelitis: Infection begins in marrow, extends variable distance, giving local abscess or diffuse suppuration. Necrosis follows when blood supply fails over a segment of bone, and always involves whole of bone.

Sequels, sequestrum formation, involucrum formation, death from pyemia, etc., or restitution.

Sequestrum: Hard, white, bathed in pus; undergoes some absorption; may be completely absorbed, but suppuration continues as long as sequestrum remains. Bacteria protected and persist in dead bone. Sequestrum may involve any portion of shaft, or whole long bone and both joint surfaces. (Specimens.)

Involucrum forms most freely in suppurative periostitis, may be bulky, very thick, spongy, condensing after recovery from infection, often riddled with cloacæ. Remarkably extensive examples of involucrum may form, covering whole of shaft of femur and both joint surfaces (specimen); or whole of inferior maxilla in phosphorus necrosis (specimen).

Demonstrations of dry bones specimens of fractures.—Simple without reaction; transverse, oblique, splintered, green-stick, comminuted, impacted. Thirty specimens.

Infected fractures with suppuration, large and small. Complete necrosis of entire shaft with involucrum. Three specimens.

Simple fractures healed, in various positions. Femur, 10; forearm, one or both bones; Colles, with dislocation at elbow; vertebrae; clavicle, one or both; sternum; humerus; one or both bones of leg; foot; pelvis; ribs; skull; etc. Numerous rarer forms of fractures and healing.

Nonunion with osteoporosis. Fibrous union. Pseudarthrosis.

Moist specimens with analysis. Effects on skin, subcutaneous hemorrhage.

Muscles, crushing, infiltrating hemorrhage throughout sheaths.

State of blood vessels, tearing, thrombosis, gangrene, secondary hemorrhage. Hemolysis in museles, and inclosed blood clots.

State of bone and bone marrow. Fate of nerve trunks.

Course of infection as determined by course of hemorrhage, and injury to soft parts, with special reference to gas gangrene.

Treatment of fractures (Le Riche).—Urges thorough cleaning away of all broken fragments, and extreme care in preserving periosteum. (1) In young subjects, if one removes bone, but leaves periosteum, it will always produce enough bone to fill defect. (2) In subjects past growth period (22 to 23), periosteum gradually loses activity, but under trauma, violent, or repeated slight, or infection, it regains power of producing bone. The regeneration from periosteum is then slightly less than the bone removed if operation is subperiosteal; it is poor and insufficient if operation is incompletely subperiosteal; it is nil if operation is extraperiosteal. In infected fractures, two to four days old, subperiosteal esquillectomy is always followed by admirable reproduction of bone after control of infection. Extreme care with fine instruments, avoiding trauma, is secret of success.

Most war fractures are infected. Few infections where there are no muscles. Injury to muscle is widespread from concussion and thrombosis of vessels. Swollen museles close wound of entrance and retain broken-down tissue, while excluding air and circulation.

In infected fractures, all loose fragments die. Attached fragments usually harbor bacteria, become source of continuous infection and seat of inflammation, and eventually die. In mild infection, marrow is destroyed for short distance and becomes clear to X ray. In bad infection, marrow destroyed to ends of bone or even into joints. Extensive sequestrums result. Thorough drainage necessary. Removal of all dead bone, recognized by white color and increased density. Dead bone may consist of outer shell or splinter involving only portion of shaft, or whole thickness of shaft, or whole bone.

Complications of fracture and accompanying injuries.—Fat embolism: Comparatively frequent occurrence, after fractures of long bones involving fluidification of marrow, crushing of fat tissues. After clean operations, sometimes trivial, on fat subjects, as breast of hernia, etc. Pathogenesis. Fluid fat drawn in venous channels reaches pulmonary capillaries and arterioles, fails to pass, and causes obstruction of blood flow. Right heart distended, pressure high. Symptoms of dyspnea rapidly increasing, cyanosis, labored pulse, coma. Fat may be forced through lungs and lodge in brain and other organs, giving intense capillary congestion with agglutination thrombi with appropriate symptoms. Minor grades of fat embolism, not fatal, probably common. Not to be confused with shock, in which the patient bleeds into his own veins and capillaries, and blood pressure in right heart is low. In fat embolism, patient dies from asphyxia.

Case report after fracture of tibia. Experimental lesions in dogs receiving olive oil. Gross and microscopic demonstrations from each.

Pulmonary embolism.—Thrombosis of veins, especially varicose veins, superficial or deep, occurs spontaneously or after injury. Thrombus extends into some large vein, as femoral, and eventually end breaks off and is carried to lungs, lodging in large pulmonary artery. Here it may cause rapid death, or, death being delayed, it may set up local thrombosis, clot ramifying to variable extent in pulmonary vessels. Infarction fails in rapidly fatal cases, but may occur and be followed by pneumonia. Anatomical diagnosis requires demonstration of broken end of original thrombus, loose embolus in pulmonary artery. Death by asphyxia.

Case report and gross specimens of pulmonary embolus from slight injury of calf, with varicose veins and Hebrews' disease.

Shell shock.—Best to assume anatomical lesions and not to attribute condition to nervousness. Concussion from shell explosion often sufficient to produce miliary hemor-

rhages in brain substance. Mott has found such lesions in brains of shell shock. Lesser lesions on fine nerve fibrils and gemmules, or nerve cells may reasonably be postulated. Many cases complicated with CO poisoning. Exhibition of Mott's findings.

WOUND INFECTION

GENERAL

Types of reaction.—(1) All pyogenic bacteria produce leucocytic exudate and simple suppurative inflammation of varying extent, bacteria remaining on superficial layers of cells. All produce and heal by granulation tissue, and leave scars.

Grades of reaction.—(a) Catarrhal inflammation: Occurs on wound surfaces, mucous and serous membranes, and in organs and tissues. Lymph nodes, kidney, joints. Essential features are exudation thrown out on a surface and exfoliation of lining cells. Exudate may be serum fibrin, blood, or pus. Little or no interstitial exudate. Complete healing usually follows.

(b) Phlegmonous inflammation: Exudative process with very rich, diffuse, leucocytic infiltration. Leaves deposit of mucin in tissues and stiffening may lead to pus pockets.

(c) Necrotic inflammation: Characterized by death of tissue from pressure of exudate or necrotic action of bacteria. On surfaces produces ulcer; in closed tissues abscesses. Always leaves permanent changes in tissue.

(d) Diphtheritic inflammation: Characterized by widespread and superficial necrosis from bacterial toxins. May affect surfaces or deeper tissues. Usually streptococcus or Klebs-Loeffler bacillus. Leaves ulcers, abscesses, scars, deformities.

(e) Gangrenous inflammation: Death of tissue in bulk, from thrombosis of vessels, large or small, and secondary putrefactive changes, with foul odor. Necrotizing action of bacterial toxins may be prominent. Moist gangrene.

(f) Septicemia: Much or little local reaction fails to stop entrance of bacteria to blood stream and bacteria circulate and grow in blood.

(g) Sepsimia: Absorption of products of tissue decomposition, with or without bacteria. Retained secundines.

(h) Pyemia: Multiple abscesses from emboli of infected blood clot of bacterial colonies. Usually from infected thrombophlebitis.

(i) Syntoxic parasitism: Absorption of aggressins, together with their specific bacteria, produces great increase in virulence of infection, increasing invasive properties by paralysis of leucocytes, proliferative properties, and toxicity of bacteria.

(j) Aggressins are specific substances developed by bacteria growing in living tissues, which paralyze leucocytes and facilitate growth invasion and toxicity of bacteria.

Sources of intoxication.—(a) Diffusible toxins: Specific poisonous ferments readily diffusing from bacteria in cultures and tissues, acting on nerve cells (tetanus), or on local tissue cells (diphtheria), or both, producing characteristic symptoms.

(b) Endotoxins: Less specific or nonspecific poisonous proteins derived from bacterial cell bodies upon their solution in body fluids, acting chiefly on nervous system, also on most organ cells, producing nonspecific symptoms very similar in all infectious diseases. Diffusible toxins produce antibodies and immunity endotoxins do not.

(c) Hemolysins, nonspecific blood-dissolving substances, of complex origin and nature, derived from toxins, endotoxins, and products of tissue change, e. g., streptococcus, *Bacilli aerogenes*. S. P. A.

(d) Toxic products of tissue change, generally repelling leucocytes, derived by various changes in splitting of protein molecule and fats. Ptoamines, very toxic alkaloids, as cholin, cadaverin. Nitrogenous bases, as leucin, tyrosin. Fatty acids, lactic, formic, butyric. Aromatic products, as indol, phenol. Simple chemicals, NH_3 , H_2S , CO_2 , H_2 . Most of these may probably be reduced by cleansing surface of wounds and removing dead or infected tissue. *Bacilli edematis maligni* produces an ammonia salt of a fatty acid which is extremely toxic. (Barger, Dale, Lancet, 1917.)

Sources of defense.—Main source of defense in all wound infections is polynuclear leucocyte. Significance of leucocytosis, local, general. Mode of action of leucocytes is by phagocytosis. Extracellular destruction of bacteria in acute pyogenic infection is quite

subordinate. Mechanical, flushing of wound by serum, and pus carries off surface bacteria. Fibrin membrane entangles and inhibits entrance of surface bacteria. Mucus generally antagonistic to bacterial growth and movement. Endothelial cells are actively phagocytic at most stages, especially later phases. Chief period of spread of bacteria is in early stages before capillaries become filled with leucocytes. Too great congestion not favorable to emigration of leucocytes, while stasis in vessels completely inhibits leucocytosis. Granulation tissue a specially effective barrier on account of its active circulation bringing abundance of actively emigrating leucocytes. Clotting blood is a strong antiseptic, while hemolyzed blood greatly favors growth of bacteria, and produces intoxication, and should be removed. Any agent injuring or inhibiting granulation tissue or procedure involving its removal is to be avoided. Postoperative "flares."

Action of local antiseptics.—No local antiseptic can penetrate inflamed tissues in bactericidal strength without damaging natural defenses. Their action, if favorable, must be the removal of surface bacteria and accumulated material which is favorable to growth of bacteria on surface and to formation of toxic products of tissue decomposition. They may also carry in oxygen and relieve anaerobic conditions. They may act as chemotactic agents drawing more leucocytes to surface. Their administration may call for more detailed general attention to wound and patient and thus relieve some unfavorable conditions commonly existing about neglected wounds. They act as mental stimulus to patient and physician. They fail with true tissue parasites like bac. tuberculosis.

Gangrene.—Always involves closure of vessels, usually of large vessels, by any means, usually thrombosis, or endarteritis, possibly only by spasm, rarely by pressure.

Dry gangrene, unattended by spreading infection or exudate, and secondary to arterial occlusion.

Moist gangrene, an acute infectious process resulting in gangrene simultaneous with occlusion of vessels.

Senile gangrene, toes, feet, fingers. Follows arterial sclerosis. Gross and microscopic specimens showing lesion in vessels.

Thromboangiitis obliterans: Erythromelalgia. Hebrews' disease. Specific course with pain from neuritis, erythema, and other vasomotor disturbances, and gangrene of extremities. Progressive. Specimens showing gross and microscopic lesions.

Gangrene from crushing injury, severing main artery, or causing thrombosis. May be immediate or delayed. Gross specimens.

Gaseous gangrene, specific, usually mixed, infection of wound, to be considered later. Specimens.

Diabetic gangrene, perforating ulcer of foot. Severe exudative inflammation of pyogenic type in specially susceptible tissues.

Spontaneous gangrene: Aeroesthesia. No demonstrable lesion occluding vessel. Case history and specimen of leg.

Gangrene of frost bite and trench foot: Occurs only after vessels have become occluded by thrombosis (very rapid cases), or obliterating endarteritis which may develop within a few days of exposure. Effects of cold include edema, serous exudation, venous stasis with vasomotor paralysis, followed by very active proliferation of fixed tissue cells. Illustrative section from frost gangrene of toe, showing endarteritis, productive neuritis, and great cellular overgrowth.

Streptococcus is the main bacterium. Many clinical types.

Erysipelas.—Usual form is a superficial, rapidly spreading infection of subepithelial lymphatics, hyperemia giving erythema. Chills, fever, intoxication, occasional bacteremia, local or general, single attack or recurrent, slight exudation, no permanent changes.

Or erysipelas may be subcutaneous, with or without cutaneous erythema, and then it is usually more severe. Exudate may then be slight and serous, or phlegmonous (many polynuclears), or diphtheritic. Bacteremia common, septicemia may occur, often fatal. These types occur with gas gangrene, hospital gangrene, etc.

Local cellulitis with lymphangitis: Common type of streptococcus infection. Early involvement of lymphatic nodes which require excision if purulent.

Superficial diphtheritic inflammation of open wounds usually caused by streptococcus: Surface covered by whitish or gray membrane, coherent and opaque if mixed with fibrin. True diphtheria of wounds also occurs.

Streptococcus tends to produce relatively little pus, extends rapidly through lymphatics rather than blood vessels, produces more intoxication than local reaction, and often lodges in serous membranes (joints), and leads to septicemia, not pyemia. Local process often diphtheritic. *Staphylococcus* produces much local reaction, much pus, seldom diphtheritic lesions, invades local vessels with infected thrombi, giving pyemia.

Tetanus.—All soil, and most foreign materials, contain *Bacilli tetani*. Hence wounds must be made unfavorable for anaerobic growth. Tetanus develops in slightly punctured, or deep penetrating, or widely lacerated wounds, where virus is protected from air. May appear at once, or weeks after wound is healed. Very slight or no noticeable local reaction. Bacteria remain localized, or travel up nerve sheaths. Symptoms due to diffusible toxin. Appearing after 12 days, prognosis favorable. Prophylactic antitoxin regularly indicated. One of the chief grounds for wide-open treatment of wounds.

Gas gangrene.—An old and well-known wound infection, very common and fatal in early days of the war; now less common and rather effectively handled by open treatment and early and thorough removal of dead tissues and blood clot. *B. aerogenes* grows vigorously when there is food for it, but disappears when there is nothing to feed upon.

Two main factors determine incidence in civil practice, fecal contamination and watery blood. Specimens. Abortion. Transfusion of infected stale saline. Terminal anemias.

Sources: Constant in feces. A saprophyte of nearly universal distribution. Samples of fresh Belgian uniform fabrics constantly infected.

Clinical types: General character of that of infective sapremia, or syntoxic parasitism. (1) Bronzed erysipelas. (2) Subcutaneous and fascial. (3) General involvement of muscles. (4) Infection of isolated muscles. (5) Delayed or latent forms, excited by operations on old wounds. (6) Metastatic. Developing in distant parts not affected by wound. (7) Septicemic. Sometimes in fulminant cases, more often a terminal invasion in anemic subject. (8) Toxic. Intoxication out of line with local lesion. (Probably mixed infection.) (9) Benign. Favorable course, with little general reaction. May be found in simple pleurisy. (10) Gaseous and nongaseous forms.

Course: Peracute; acute; chronic.

Development of lesion: (a) Preparatory—main factor is injury of muscles, direct or from splinters of bone, or from shutting off blood supply; equally important is blood clot, especially haemolyzed blood. Intramuscular hemorrhage balloons out the muscles from end to end and occludes vessels. (b) Infection—cadaveric rigidity said to mark line of advance in infected muscle, a true coagulation of myosinogen. Serous exudate abundant precedes leucocytes. Rich and effective leucocyte exudate in favorable cases, little in bad cases. Gas infiltration often splits up tissues and facilitates spread of bacteria. Yet in dead rabbit muscle bacillus travels in muscle planes 2 cm. in 24 hours. Thrombosis of vessels sets in promptly and favors growth of bacilli. Hemolysis proceeds rapidly and destroys protective power of blood. Necrosis of muscle results from infarction. (c) Putrefaction—secondary changes a complex process, many bacteria being usually concerned. Muscles dark red when first infected, later change to yellowish brown or chocolate black. Fibers homogeneous, then fragmented, swollen, disintegrated, giving rise to many toxic products of tissue change, of which little is known.

Biochemistry: (Henry, *B. M. J.*, 1917, i, 806.) First stage.—Active growth in muscles due to abundance of glycogen which is split by saccharolytic action of *B. aerogenes*. Glycogen converted into lactose and maltose, these again into acids and gas. Gases are CO₂ and H₂. Excess acids tend to limit growth of bacillus, but these are neutralized by alkaline fluids and blood. Wright's treatment by intravenous sodium bicarbonate designed to limit supposed acidosis, not very effective.

Second stage—acid formation succeeded by proteolytic action which dissolves muscle and yields ammonia compounds. H₂S is given off and muscles darken. In this stage, more severe systematic intoxication appears. In acid stage, muscles are brick red.

Treatment: Principles suggested by known pathology of diseases are thorough removal of bacterial nutriment, contused muscles, dissecting out muscles infiltrated with blood, removal of blood clot, cleaning out bone fragments and all foreign material. Maintenance of circulation. Blood transfer for anemia. Oxygen. No evidence appears of true toxin pro-

duction, but reports of serum treatment, theories to contrary, are encouraging, and should be watched with caution. Bacteriology of disease is usually complex and involves bacteria for which no immunity has thus far been produced for man; e. g., streptococcus, endotoxins, tissue products, ptomaines, ammonia compounds.

Results of serum treatment: (Weinberg, *Royal Soc.*, July, 1916).—Three sera from *B. perfringens*, *B. edematiens malignans*, and *Vibrio septique* gave immediate good effects in 10 of 15 cases. In 5 septicemic cases, there was no benefit. Thinks antitoxic sera will have better preventive than curative effect against *B. edematiens malignans* and *Vibrio septique*. These toxins rapidly combine with nervous tissue in one hour. Recommends immediate injections in and about wound of three mixed sera, then, from results of bacterial culture, choose the one most indicated.

ANATOMY OF THE EXTREMITIES, WITH SPECIAL REFERENCE TO THE STRUCTURES INVOLVED IN FRACTURES AND DISLOCATIONS

This course consists of six demonstration conferences, during which a very extensive collection of fractured bones and old joint dislocations, ankyloses, and dissections of muscles about bent and stiff joints are examined. Dissections of the joints and soft parts of the limbs, as well as models and charts, are used extensively.

First lecture.—The muscular and bony attachments of the arm to the neck and trunk. It is brought out, by means of models and specimens, that the arm is chiefly held to the body by extensive muscular attachments. Posteriorly, these muscular attachments begin at the occipital bone of the skull by means of the trapezius muscle and extend throughout the length of the vertebral column, and finally through the latissimus dorsi the arm is actually attached to the posterior part of the iliac crest or the girdle of the lower extremity. The arm posteriorly is held to the body by means of muscle attachments from the head to the sacrum. Anteriorly the muscular connection is much less extensive, yet, by means of the omohyoid, it begins at the hyoid bone and extends through the pectoralis major and other muscles to the breastbone and ribs. The numerous muscles, all of which are demonstrated, hold the arm by means of insertion into the arm girdle, the clavicle and scapula, as well as by insertion into the humerus or arm bone itself. The toughness, or strength, of these muscles is responsible for holding the arm to the trunk against violent pulls and forces, tending to tear it away. Should these muscles be broken or ripped away, the only bony or joint connection between the arm and the trunk is the small sterno-clavicular articulation. This joint owes its strength solely to its capsular ligament. The possible injuries and dislocations of this joint are considered.

The fractures of the clavicle are then considered. The parts of the bone more likely to be broken are pointed out, and in every case a consideration of the muscle pull on the broken parts is gone into. The possible injuries of the soft parts, such as the nerves and vessels that lie beneath the bone, are discussed and the exact position of these structures is shown on the specimens. The valuable rôle of the subclavian muscle is recognized as often protecting the large subclavian artery and vein, as well as the brachial plexus of nerves, all passing between the clavicle and the first rib.

The joint between the clavicle and scapula is briefly described and shown with specimens. Fractures of the scapula are demonstrated, and the resulting derangement of muscle pull and muscle positions are analyzed.

Dislocations of the shoulder joint: The most common dislocation of this joint are taken up in their order of frequency. The muscles, passing from the scapula to the tubercles of the humerus, are described as holding the head of the humerus close into the glenoid fossa of the scapula. In all dislocations some of the muscles are stretched or torn, and it is demonstrated which muscles are affected in shoulder dislocations passing in given directions. The mechanics of the joint, its freedom of movement and strength in different positions, are reviewed. The relationships of large vessels and nerves in the shoulder and axillary regions are fully demonstrated.

Second lecture.—The arm, as a whole, is divided into ventral and dorsal surfaces, separated by preaxial and postaxial borders. On this basis the muscles may be grouped according to their positions and actions. The muscles of the ventral surface being flexors, those of the

dorsal surface very largely extensors. The arrangement of the cutaneous nerves, and also the innervation of the muscles, may be simply analyzed in connection with these surfaces and borders. The muscles are thus treated in functional groups, and their innervation corresponds with the group arrangement. This view of the subject enables the surgeon to understand and to know the muscles and nerves without attempting to burden his memory with the details of anatomy. The complexities of given movements are briefly considered so as to show the various muscle groups involved in performing a certain action of the arm. By the use of these analyses, it is shown how paralysis of certain muscles and fractures at different places in a bone might be diagnosed.

The humerus is studied in regard to the strength of the bone in its various parts, and the attachments of muscles were found to correspond with certain changes in strength in the different parts of the bone. The upper epiphysis is considered from the standpoint of possible epiphyseal fractures in young men, and the pull of the scapular muscles on the tubercles as part of the epiphysis is pointed out. A large collection of humeri that had been fractured in various places during life are shown, and the displacement and shortening of the bone is explained from the standpoint of the direction and force of muscular pull on the parts of these specimens. The relationships of the large nerves and vessels of the arm to the bone are reviewed, with special reference to the most favorable points for compressing the brachial artery against the humerus.

The regional anatomy of the elbow joint is discussed, after which a full consideration of dislocations and fractures in the region of this joint is undertaken. A number of old fractured and ankylosed elbow joints are demonstrated. The movement of the forearm on the upper arm at this joint is analyzed from a mechanical standpoint. The obtuse (carrying) angle formed between the upper and forearm is shown; and the significance of this bend, on the line of pull is demonstrated.

Third lecture.—The forearm and hand: The movements of pronation and supination are analyzed; and the general relationships between the radius and ulna are shown in the various phases of these movements. The arrangement of the muscles on the radius and ulna and the influence of these muscles on the fragments resulting from fractures of the radius and ulna are discussed. The arteries and nerves of the forearm are demonstrated in their relationships to the muscles and bones. Fractures and dislocations of the wrist and carpal joints are discussed, and a number of specimens showing fractures of these regions are demonstrated. The fascial compartments and tendon sheaths in the hands and wrists are reviewed in connection with possible distribution of infections, etc., in the fingers and hand. The general anatomy of the vessels and nerves, tendons and muscles in the hand are briefly summarized and the useful landmarks and method of locating the internal structures are pointed out.

Fourth lecture.—The support of the trunk on the pelvic girdle: The strong and close connection of the trunk with the pelvic girdle is contrasted with the loose muscular attachment of the pectoral girdle to the trunk, which was considered in the first lecture. The regional anatomy of the pelvic girdle is briefly reviewed. The main and tie arches of the girdle are then considered. The femoro-sacral, or standing arch, and its tie arch are discussed in connection with certain fractures and the strength of the pelvic girdle in general. The ischio-sacral, or sitting arch, and its tie arch are considered in a similar manner, and dislocation which might occur in the pelvic girdle are then briefly reviewed.

The mechanics and strength of the hip joint are analyzed with the view of more fully understanding the conditions following the different dislocations of this joint. With ligament preparations, it is shown what positions the head of the femur would occupy in the several hip joint dislocations. In each case the muscles that may be stretched and torn are discussed. The ligaments of the capsule are described in connection with their behavior in the various dislocations, and the uses of these various ligaments and muscles in reducing the dislocation are described.

A large number of specimens are then used to demonstrate various fractures of the neck and upper parts of the femur. The collection available for this purpose is extensive and extremely elucidating in a consideration of the various compacted conditions of the head of the femur, resulting from severe injuries to the hip joint.

Fifth lecture.—The thigh and knee: The thigh and leg, as a whole, are divided into ventral and dorsal surfaces, separated by pre and post axial borders, as was done in the case of the arm. The thigh and leg, however, have been rotated to such a degree in development that their dorsal surfaces are forward or toward the ventral surface of the trunk. Keeping this in mind, the muscles of the thigh and leg may be arranged in functional groups similar to those of the arm, the extensor muscles being found on the front or dorsal surface of the limb, and the flexor muscles are on the ventral surface of the limb which is toward the back of the body. The distribution of the cutaneous nerves is also rendered simple by this division of the limb into surfaces. The innervation of the muscle groups here again as in the arm makes it possible for the surgeon to understand their function and arrangement without depending upon the details of anatomy. A large collection of fractured femurs are shown, and the line of union between the two fragments indicates the direction of muscular pull which has been exerted on the lower fragment. The places on the femur most frequently fractured and the muscle pulls on the fragments during various degrees of flexion at the knee are pointed out.

The regional anatomy of the knee joint is briefly reviewed, with a careful consideration of the synovial cavities of the joint and the neighboring tendon sheaths and bursæ. Dislocations of the knee joint are then discussed from an anatomical standpoint.

Sixth lecture.—The leg and foot: The general anatomy of the leg and foot is briefly reviewed on dissected specimens. Fractures of the tibia and fibula are demonstrated with a considerable number of these fractured bones, and the displacement of the fragments is discussed in the light of the muscle pulls involved.

The ankle and tarsal joints are reviewed and the dislocations and fractures of these joints and bones considered.

The arches of the foot are carefully analyzed and the conditions of fallen arch and flat foot thoroughly discussed from the anatomical standpoint. The competition between the tibialis and peroneus muscles is discussed in connection with the normal position and direction of the foot in standing and walking.

The tendon sheaths and fascial compartments of the foot are described in connection with their importance as influencing the distribution of infections, etc. The general arrangements of the vessels and nerves and the relationships of the tendons and bones in the ankle and foot are demonstrated on dissected specimens. Finally, the foot is considered from a mechanical standpoint, as the pedestal or basis on which the body must stand and move.

SYLLABUS OF THE COURSE OF INSTRUCTION GIVEN IN BELLEVUE HOSPITAL

The object of this course is twofold: (1) The practical treatment of fractures; (2) the practical treatment of infection.

1. Instruction is given in the principles, the structure and the application of the standard splints adopted by the United States Army. In this work the officers are required to become entirely familiar with the various splints and their uses. In order that they may practically learn those factors which tend to comfort or discomfort on the part of the patient, the first instruction is carried on with some of their own number acting as patients. Later they used uninjured patients in the wards and finally apply the splints and various apparatus to patients whose injuries demand their use for therapeutic reasons. The service affords from 30 to 40 such patients for each class. This work includes the setting up of the Balkan frame, and using it as a means of putting into effect the principles of suspension and traction in compound fractures of both the upper and lower extremities. This work is closely supervised, and is accompanied by lectures based on the work of Silver, Flint, Blake, Jones, and LeRiche.

2. Instruction was given in the operating rooms and wards in the practical lessons which military surgery has taught in the treatment of both contaminated and suppurating wounds of the soft tissues and bones. Emphasis is laid throughout upon the principles which are coincidentally being taught in the laboratory courses, in anatomy, chemistry, bacteriology, and pathology. Necessarily, there is some variation in this part of the work with different classes, because of the variation in clinical material in the wards, but in general the same plan is followed. The purpose of this plan is to demonstrate those facts in treatment which all authors agree the war has proved.

(a) Severe contaminated wounds may be rendered clean if proper attention is paid to the elimination of all foreign matter, including that resulting from blood and tissues which have been damaged beyond hope of repair. Attention is given to the mechanical and chemical cleansing of the wound within the first six or eight hours. The teachings of Moynihan, Carrel and Dakin, Wright, Depage, Tuffier, Blake, Dunham, Le Compte, Lee and Furness, and others are followed in this. For this purpose all proper traumatic cases are operated upon before the class, particular attention being given to the principles involved.

(b) Badly infected and suppurating wounds may be rendered surgically clean by proper application of the above principles, associated with the use of physiological and chemical antiseptics. In teaching this phase of the subject, intensive instruction is given in the technique of using Carrel tubes, the dichloramine-T-oil spray, and the principles underlying the use of the Wright hypertonic salt solution and salt pack. The officers are permitted to do the actual dressings in this part of the work, and insistence is laid upon correct technique in each step.

(c) Wounds thus rendered surgically clean may be sutured or grafted, and the period of convalescence much shortened by this means. In this work the officers study the bacterial count and determine when the suturing shall be done. They then witness the latter and follow the results. Throughout this course the endeavor is made to emphasize the underlying principles of pathology and bacteriology which control wound healing, with the practical technical application of therapeutic measures which tend to overcome those factors that lead to continued disability. The object to be attained is the most prompt return of the wounded man to the most nearly normal condition possible. Further instruction is given along these lines by Captain Butler in the demonstrating room and by didactic lectures.

Another phase of the course has to do with the treatment of burns. The service furnishes a large material for this subject, and the officers are taught the use of the dichloramine-T oil, the paraffin compounds, the hot-air treatment, and the comparative value of the alkaline and the acid dressings. For the latter, an unpublished method is used. The surface of the burn is first covered with one layer of coarse gauze impregnated with the vaseline-resin-paraffin (see under Carrel treatment), used to protect the skin against sodium hypochlorite solution, and over this is applied a gauze dressing continuously wet with a 0.5 per cent solution of acetic acid. This results in a very prompt digestion of all necrotic tissue, and the establishment of healthy, clean granulations. If kept thoroughly wet, the dressing causes very little pain, and by many patients is pronounced more comfortable than any other form of treatment. The vaseline gauze permits the daily change of dressing without damage to epithelial islands. But two precautions are necessary; the vaseline gauze must be coarse mesh, about 16 by 20, must be applied in but one thickness, and the outside dressing must be kept well wet, but not dripping, the entire time. To this latter need the patient himself, or any ward attendant can attend, as dryness results in pain, indicating when more solution should be used.

INFECTED WAR WOUNDS ¹

a. The general problem of infection in this war.

I. Comparison with other wars.

II. Remarks by various writers.

III. What infection meant in the early part of the war.

b. Causes of such widespread infection.

c. The steps employed to combat infection, and the results therefrom.

I. Pure surgical steps—mechanical sterilization.

(a) The exponents and their results.

II. The physiological process.

(a) Wright's hypertonic salt solution.

(b) Various techniques for employing the hypertonic salt.

(c) Added use of vaccines.

¹ For full discussion of this subject see Vol. XI, pt. 1. Details of course of instruction are omitted here.—Ed.

III. Chemical sterilization.

- (a) Past history of chemical sterilization.
- (b) Requirements for good antiseptics, and natural limitations of chemical procedures.
- (c) The varied possibilities in chemical compounds.
 - 1. Phenol, etc.
 - 2. Salts of the heavy metals.
 - 3. Oxidizing agents, and other varied types.
 - 4. The dyes.
 - 5. The chlorine group.
 - 6. Hypochlorites.
 - (1) Early history.
 - (2) The physical and chemical characteristics.
 - Strength of watery solution.
 - Reaction and stability.
 - Length of time in which work is done.
 - (3) Special technique necessary.
 - (4) Apparatus necessary for the method.
 - For preparation.
 - For checking up on wards.
 - For each individual patient.
 - For dressing carriage.
 - For bacteriological study of wound.
 - For surgical supply room.
 - (5) Team work an essential.
 - (6) Method of doing the dressing.
 - (7) Objections to the hypochlorite sterilization.
 - 7. Dichloramine.
 - (1) Early history.
 - (2) The physical and chemical characteristics.
 - Strength of oily solution.
 - Stability.
 - (3) Solvents for dichloramine.
 - Eucalyptol.
 - Paraffin oil.
 - Chloreosane.
 - Necessity for chlorination.
 - (4) Method of preparing the solution.
 - (5) Apparatus necessary for the technique.
 - For preparation of the solution.
 - For the dressing.
 - For the surgical supply room.
 - (6) Objections and comparison with hypochlorites.

d. Certain special types of infection.

I. Tetanus.

- (a) Mode of action of *B. tetanus*.
- (b) Observations made during war.
 - 1. Report of R. A. M. C.
 - 2. Atypical tetanus.

II. Gas infection and gas gangrene.

WAR WOUNDS IN GENERAL

- a. The physiologic concept of the soldier.
- b. General statistics regarding war casualties.
 - I. Other wars.
 - II. Present war.

- c. Causes of injuries and surgical conditions.
 - I. Cases other than battle casualties.
 - II. Missiles and other weapons.
 - III. Poison gas, fire, etc.
- d. Transportation of wounded, and question of speed.
- e. Complications of wounds.
 - I. Exposure to cold and weather.
 - II. Lack of food and water.
 - III. Shock and hemorrhage.
 - IV. Trench foot.
 - V. Physical fatigue.
 - VI. Psychic fatigue and shell shock.
 - VII. Asphyxiation.
 - VIII. Burns.
 - IX. Other complications.
- f. Special types of injuries.
 - I. Fractures.
 - II. Head injuries.
 - III. Abdominal injuries.
 - IV. Chest injuries.
 - V. Other special injuries.

* * * * * * *

Not alone have the pyogenic organisms attracted attention in this war, but also the great class of the fecal anaerobes. This group embraces, among others: Tetanus bacillus, gas bacillus, bacillus of malignant edema, *B. edematiens*.

Two in particular have been causes of great mortality in the early part of the war, and have been the subjects of much study: Tetanus (quickly overcome), gas bacillus (still a serious condition).

Tetanus had been exhaustively studied prior to the war, and been controlled under conditions of civil life. At the beginning of the war, it was a serious problem chiefly because no adequate system had been provided for giving the wounded prophylactic treatment. As soon as provision was made for supplying the advanced dressing stations with enough antitoxin, it ceased to be such a serious problem.

Mode of action of tetanus bacillus.

Found in the richly manured soil.

Normal inhabitant of the intestinal tract of horse.

Carried into the wound on foreign bodies.

Anaerobic life.

Localized growth of the organisms.

Production of exotoxin.

Toxin reaches cord through the nerve trunks from the wound.

Secondary importance of spread through blood stream.

Clinical signs of infection.

No local reaction, as with pyogenic organisms.

Incubation period, and relation between the length of the period and the severity of the case.

Classical symptoms.

Recent observations on the earliest symptoms.

General irritability.

Increased reflex irritability and muscle spasm in the affected extremity. (Relation between the mode of reaching the cord and the part first affected.)

Atypical tetanus, and the relationship between the amount of toxin and antitoxin in the cases with localized symptoms.

Delayed tetanus.

Factors causing sudden flare-ups.

Mortality statistics.

Various methods of treatment.

Surgical—prophylactic.

Wound cleansing and institution of adequate antisepsis.

Surgical—therapeutic.

Amputation—reasons why; poor results.

Nerve drainage—reasons why; poor results.

Drugs—therapeutic.

Opiates and sedatives—reason why; limits.

Mag. sulph.—mode of action; results.

Antitoxin—prophylactic.

Number of "units" necessary—American, British.

Duration of immunity, and optimum periodicity of injections.

Question of anaphylaxis—methods of guarding against it and treatment.

Prophylaxis for delayed tetanus.

Time necessary for absorption from different parts.

Antitoxin—therapeutic.

Time to institute treatment.

Points for administration.

Number of "units" to give, frequency, etc.

General statistics regarding gas bacillus.

The *Bacillus aerogenes capsulatus* has long been known, but it has never been conquered in civil life, as has *B. tetanus*.

Very great incidence of "gas infection," with much lower incidence of "gas gangrene."

Mode of action of organism.

Occurrence in nature, and mode of access.

Influence of foreign bodies on growth.

Early localization, and later widespread.

Theory of symbiosis.

Association with streptococcus.

Preparation by streptococcus or other organism for the spread of *B. aerogenes*.

Intoxication from products of necrosis.

Roll of gas in opening channels.

Theory of Bull.

Production of exotoxin in vitro.

Experimental evidence.

Nature of toxin.

Antitoxin, and experimental results.

Ability of *B. aerogenes* to prepare its own soil for growth.

Clinical signs and symptoms.

Earliest—muscle rigor.

Cutaneous changes.

Crepitation.

Odor.

Incubation period.

Toxemia.

Morbidity and mortality.

Treatment.

Surgical—prophylactic.

Early adequate surgery, especially the removal of all foreign bodies and devitalized tissue.

Surgical—therapeutic.

Very radical surgery, amputation if necessary, excision of all affected muscles.

Antiseptic—prophylactic.

Early use of antiseptics.

Oxidizing agents.

Treatment—Continued.

Antiseptic—therapeutic.

Dakin's solution, detoxicating effect.

One per cent chlorohydrate of quinine.

Oxygen needled into involved tissue.

Antitoxin—prophylactic.

Still subjudice.

Antitoxin—therapeutic.

Still subjudice.

General statistics.

* * * * *

THE SURGERY OF FRACTURES

Fractures, types of:

1. Closed or simple.

2. Open or compound—special type gunshot.

Mechanism:

Direct violence.

Indirect violence.

(Special type, museular action.)

Symptoms:

Pain—

1. On direct pressure—digital.

2. On indirect pressure.

3. On cross strain.

Deformity—

1. Long axis.

2. Transverse axis.

3. Axial rotation, etc.

Abnormal motion.

Crepitus.

Change in soft parts, ecchymosis, skin blebs, laceration of muscles, injuries to blood vessels, nerves, etc.

Shock.

Fat embolism.

Treatment:

First aid—

Weight bearing—nonweight bearing bones.

Closed or open fractures—

First essential is rest. Avoid unnecessary examination and manipulation.

Remove clothing, splint injured part with apparatus at hand in axis of limb.

Give morphine.

Upper extremity—

Arm to chest—axillary pad.

Screen-wire and wood splints.

Thomas arm splint—elbow splint.

Lower extremity—

Rifle down side of leg—folded coat or blanket between leg and bind legs together.

Wooden splints, wire or metal splints.

Thomas knee splint.

Open (compound) fractures—

By direct violence, gunshot—

Transportable.

Nontransportable.

By indirect violence.

Treatment—Continued.

First aid—Continued.

Cut away clothing.

Treatment of the wound—iodine over skin and projecting bone.

Dressing—sterile dressing or alcohol dressing.

Immobilization in long axis, avoiding unnecessary handling.

Hemorrhage—

Elevation.

Pressure.

Tourniquet.

Ligation of vessels.

Immediate amputation.

Treatment of wound in soft parts in fractures by direct violence and gunshot fractures:

Inspection to determine—

If transportable.

If not transportable.

Early adequate surgery:

Wide opening and exposure, leaving no pockets; removal of foreign material; cut away dead and contaminated tissues; remove loose bone fragments.

Sterilization of wound—

Before six hours.

After six hours.

Formalin 1 per cent, H_2O_2 , saline.

Iodine.

Dakin-Carrel.

Dichloramine-T, in chlorinated eucalyptol.

Clumsky solution, etc.

Modern method of treating fractures:

1. By massage and mobilization.

2. Manipulation with fixation by external device after reduction.

3. Splints—

Wooden, wire, tin, etc.

Plaster splints, molded plaster.

More complicated and orthopedic splints, Thomas type.

4. Extension methods—

1. With straight limb—

Buck's extension with Volkman sliding rest. (Bardenheuer and Cologne school.)

2. With flexed limb—

Hodgen splint (with combined traction of Stimson).

Zuppinger, inclined plane, etc.

Balkan splint.

By transfixing nails, rods, etc.

5. Open operation.

GENERAL CONCEPTIONS

1. Unnecessary manipulation under improper surroundings should be avoided. Splint the fractured area (in the long axis of the limb, if an extremity) and transport the patient to a place suitable for the handling of the injury in question. If the patient is in shock or pain, use morphine. If an open fracture, iodine on skin, sterile dressing. Treat major injuries (blood vessels) at once. Otherwise prepare for transportation to fully equipped station.

2. Reduce the fracture as soon as possible after the injury. This reduction should not be delayed beyond two hours. In open fractures, before six hours, excise loose fragments, remove foreign material, excise contaminated and devitalized tissues, sterilize wound. If possible to close, insert sutures to be tied if wound remains clean. After six hours, treat as above, except leave wound open and close later when wound has become free from infection.

3. Reduction and the proper and complete examination to determine the type and character of the fracture should be done under an anesthetic. (Naturally the same general contraindications to the use of an anesthetic apply here as are found to apply in other fields of surgery.)

4. Have an X-ray plate made if such a plate can be made without unnecessary delay. No reduction should be delayed, however, beyond the time set in paragraph 2 to await X ray. An X ray must always be made after a reduction and should be made the day of the injury. It is, perhaps, superfluous to add that the surgeon should interpret the X-ray plates himself.

5. Every fracture treated by traction should have an X ray taken with the traction apparatus in position and in full operation.

6. Every fracture of the long bone should have the proximal and distal joints included in and immobilized by the fixation apparatus.

7. The fixation apparatus used should be easily removable, procurable everywhere, and should not be applied too tightly.

8. If the fracture is obviously irreducible, or if the X ray taken after the supposed reduction shows that that reduction is unsatisfactory, other treatment should be institute promptly.

9. Operation should be done within the first 14 days; 4 to 7 days for the smaller bones, 9 to 11 days for the larger bones. All cases operated upon later than two weeks should be considered as late operations. (Obviously operation may be done immediately for complicated injuries to the soft parts.) Open fractures should be operated upon as early as possible. (See par. 2.)

Use of X ray in fractures.

Delayed union; nonunion; pseudoarthrosis.

Process of repair in bone.

Effect of suppuration upon repair.

Regional fractures.

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INJURIES OF SKULL, SPINE, AND PERIPHERAL NERVES

INJURIES OF SKULL

Injuries.—Menace of infected wounds of skull coverings. Contusions of skull, causing hematoma, epidural hemorrhage, contusions of brain. Punctate hemorrhages, possible subsequent degenerative changes.

Symptoms.—Symptoms due to fracture proper, plus hemorrhage, brain trauma; immediate, secondary, infection.

Treatment and operative technique.—Wounds of skull; incised; puncture; fractures of vault of skull (simple or compound); fissured; inner table only; depressed, comminuted; gunshot.

Fractures of the base of the skull (simple or compound).—Symptoms due to hemorrhage, escape of spinal fluid, injury to brain, injury to cranial nerves; infection.

Treatment.—Operative technique of subtemporal decompression.

INJURIES OF SPINE

Contusions.—Local symptoms; possible cord symptoms, from punctate hemorrhages hematomyelia.

Treatment.

Sprains.—Gradually induced by heavy load; suddenly induced by heavy lifting, falling, or impact of falling weight.

Treatment.

Dislocations.—Usually associated with fractures; otherwise usually without cord symptoms.

Fractures and fracture dislocations (with or without cord injuries).—Direct violence, involving usually, spinous processes and laminae; any portion of vertebra when due to projectiles; indirect violence, involving, usually, crushing of bodies, plus, in severe cases, dislocation, with possible fracture of articular processes and arches.

Symptoms.—Without cord involvement, local signs of fracture; with cord involvement, local signs of fracture, plus cord symptoms varying with level of the lesion and completeness of damage to cord; immediate; remote.

Treatment.—Operative technique.

INJURIES OF PERIPHERAL NERVES

General consideration as to nerve properties.—Trophic centers; degeneration; time involved; lapse of time after which regeneration may occur; result of nerve paralysis on muscle.

Division of nerve.—Incomplete and complete; physiological; anatomical; nerve bulbs on proximal and distal stumps.

Pathology.—In nerves, early; in muscles, late.

Symptoms.—Vary with site of lesions and completeness of division; primary roots, motor; peripheral trunks, sensory; lapse of time after injury; early; late.

Treatment.—Rendering wounds sterile; preventing overstretching of paralyzed muscles; nerve repair as soon as is feasible; physical therapeutics before and after operation.

Types of operations.—Neurolysis; end to end suture; various implantations; transposition; transplantation; bridging; suture materials; protection with eargile membrane.

After treatment.—Physical therapeutics; reeducation.

Results.—Immediate; remote.

PATHOLOGY OF TRAUMA OF THE SKULL AND CONTENTS

Three lectures, with demonstration of specimens illustrating injury to the skull, brain, and its membranes, with consideration of the mechanism and clinical history as an aid to diagnosis, localization, and treatment.

1. *The mechanism of fractures of the skull.*—Direct fractures of the vault at place of contact of violence. Localization of the fracture in relation to associated intracranial hemorrhage. Fracture without wound or abrasion of scalp; localization by hematoma of scalp at place of contact and extracranial hemorrhage into scalp from fracture.

2. *Traumatic intracranial hemorrhages.*—Clot from laceration of the middle meningeal artery by fracture. Subdural clot from laceration of the brain. Anatomy and mechanism of indirect laceration of the brain an aid to the localization where focal symptoms are absent.

3. *Compression of the brain.*—(a) Compression by traumatic hemorrhage. Disease associated with hemorrhage producing compression. Internal hemorrhagic pachymeningitis, central cerebral hemorrhage (apoplexy), ruptured aneurysm of circle of Willis and branches. (b) Compression by suppurative inflammation. Internal suppurative pachymeningitis from punctured wound of skull (subdural empyema). Suppurative meningitis (leptomeningitis) from infection through fracture. Traumatic suppurative meningitis without fracture. Abscess of brain. The cerebrospinal fluid obtained by lumbar puncture an essential aid in diagnosis and treatment.

TRANSFUSION*

The life-saving effect of transfusion upon patients who have passed into a serious condition as a result, in whole or in part, of hemorrhage, is universally acknowledged.

* * * * *

As regards the indications for transfusion, the more the condition of the patient is due to a loss of blood, the greater is the benefit which may be expected from transfusion. No fact so emphasizes the importance of this indication for transfusion as the difference between the results following the use of transfusion in depressed states of vitality due to pure hemorrhage and to pure shock.

In contrast to the almost literal resurrections following transfusion after hemorrhage, the results in conditions due to shock alone are disappointing. This is a fact which has been confirmed by a number of observers, notably in a recent article by Archibald and McLean (Shock in War Surgery, *Annals of Surgery*, September, 1917, lxvi, No. 3, 280). It is a fact supported by animal experimentation, and one quite in accord with the best accepted theories of the nature of shock.

*For a full discussion of this subject see Vol. XI, pt. 1, Chap. VII, p. 185. Details of course of instruction are omitted here.—Ed.

The symptomatology of the states produced by both shock and hemorrhage is so similar that only the history may enable one to determine to which of the two causes the depressed condition of the patient is due. The distinction, however, is of greater theoretical than practical importance, because hemorrhage and shock are more often combined in the same patient than otherwise, and the patient should then be treated as a case of hemorrhage. The favorable result of the transfusion will be directly proportional to the degree with which the symptoms are due to hemorrhage.

Unquestionably the loss of blood when it occurs early, as it usually does, protects the patient against the internal sequestration of a large proportion of the circulating blood, upon which sequestration the development of shock depends. This fact is, doubtless, the explanation in a large degree for the favorable results following transfusion after hemorrhage in patients also subjected to causes of shock. It is, however, desirable to recognize the usual ineffectualness of transfusion in shocked patients who have not suffered from hemorrhage.

While hemorrhage is the usual indication for transfusion in war surgery, it is not the only indication. Instances of poisoning by carbon monoxide occur in the Army, and the usual beneficent results have followed transfusion of patients so poisoned. (Robertson and Watson.) Transfusion is of great value in anemic conditions preceding serious operations.

Other indications for transfusion chiefly concern medical cases. They include the various anemias:

- Secondary anemia.
- Pernicious anemia.
- Leukemia.
- Baeteremia.

And as a last resort in desperately ill medical cases.

The following are some of the specific conditions for which transfusion has been used in a series of 165 instances reported by Unger:

1. Hemorrhage:

- Gastric and duodenal ulcer.
- Typhoid fever.
- Postoperative hemorrhage.
- Ectopic gestation.
- Uterine hemorrhage.
- Ulcerative colitis.
- Jaundice.
- Hemorrhage associated with blood diseases.
- Micellaneous cases—
 - Hematemesis of unknown origin.
 - Intestinal hemorrhage of unknown origin
 - Multiple hereditary telangiectases.

2. Blood diseases:

- Secondary anemia.
- Pernicious anemia.
- Hemophilia.
- Purpura hemorrhagica.
- Leukemia.
- Bleeding of new born.
- Banti disease.
- Von Jakseh's anemia.
- Henoch's purpura.

3. Toxemias:

- Pneumonia.
- Pyogenic infections with extreme toxemia.
- Coal-gas poisoning.
- Morphine poisoning.
- Uremia.
- Scourvy.
- Toxemia of pregnancy.

4. Infections:

Localized pyogenic infections.

Bacteremia.

5. Shock.

6. General debility, previous to operation.

Meleney, Steerns, Fortune, and Ferry (*American Journal of Medical Science*, Nov., 1917, cliv, No. 5, 733) have concluded, as a result of a review of 64 of these medical cases, that the treatment was merely palliative in the majority, but to a degree which in no way detracts from the value of the procedure; for many incurable patients have been given months of fairly good health, and, in many instances, spontaneous remissions have been definitely hastened. Of the medical cases, the pernicious anemias have been most benefited.

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X-RAY DIAGNOSIS

LECTURE I

Introductory:

The production of X rays.—Phenomena of electric discharges in air; in vacuo. The energizing current. Cathode stream. X rays. Gas tube. Coolidge tube. Properties of X rays. Penetration. Fluorescence. Ionization; chemical effects. Absorption by various tissues. Record of densities as shown on fluorescent screen; on plate. Central ray. Divergent rays. Distortion. Technical axioms. Application. Methods of X-ray examination:

Fluoroscopy—general.

Orthoradioscopy—examination with central ray.

Radiography.

Stereography.

Teloradiography.

Serial radiography.

Posture.—Positions. Centric examination. Sagittal views. Frontal views. Oblique views. Eccentric examination. Methods of immobilization. Use of contrast media: esophagus, gastrointestinal tract, sinuses.

LECTURE II

Interpretation: Tissue density as shown on plate. Determination of posture, position, side, age, sex.

1. Appearance due to artifacts—plate, developer, movement of part.

2. Appearances due to foreign bodies—clothes, buttons, teeth filling, bandages, immobilization apparatus.

3. Appearances due to soft tissues—muscles, tendons, ligaments, breasts, buttocks.

4. Normal Roentgen anatomy—epiphyses, developmental variations. Interpretation of pathological findings on clinical and pathological basis.

5. Variations—in relation to clinical symptoms.

6. Accidental findings.

7. Negative examinations.

8. Limitations of the X-ray examination. Methods of analysis—fractures and dislocations, bone diseases, joint diseases, thoracic diseases, gastrointestinal diseases.

LECTURE III

Fractures.—Fluoroscopy, radiography, technique of arrangement for various views of various joints. Sources of error, study of deformity; study of callus.

Scheme of analysis

Bone

R. L.

----- cm. from -----	(Bony landmark)
Variety:	
Simple.	
Sprain.	
Multiple.	
Comminuted.	
Epiphyseal.	
Line of fracture:	
Complete.	
Incomplete.	
Green stick.	
Fissure.	
Direction:	
Oblique.	
Longitudinal.	
Transverse.	
Spiral.	
T-shaped.	
V-shaped.	
Stellate.	
Irregular.	
Displaced fragment (degree) (0, 1, 2, 3).	
Upper fragment }	direction.
Lower fragment }	
Overlapping.	
Union.	
Associated fraetures.	
Complications:	
Inflammation.	
Tumors.	
Syphilis.	
Foreign bodies.	
Operative procedures.	

LECTURE IV

Bone inflammations.—Normal bone markings—Haversian system as shown on plate; pathological basis of radiographic appearances in periostitis, ostitis, osteomyelitis.

Scheme of analysis for radiographic study of bones

Periost. (periosteal shadow is to be differentiated from the cortical shadow only under pathological conditions):

1. Exudative.
2. Productive.
3. Destructive—periosteal; subperiosteal.

Cortex.

1. Atrophy (shown as loss of bone density)—
 - Lamellar—lamellæ intact.
 - Lacunar—lamellæ perforated.
2. Sclerosis—productive process—general; localized.
3. Necrosis—destructive process—inclosed by sclerosis; not inclosed by sclerosis.
 - Erosions.
 - Defects.

Medulla—

Atrophy.

Widened.

Narrowed.

Soft tissue:

1. Infiltration—localized; general.

2. Sinus formation; air—

Macular—in connective tissue.

Linear—in muscle tissue.

3. Calcification—sequestal, interstitial, arthritic.

Diagnosis.

LECTURE V

Study of chest.

Relation of air content to illumination of pulmonic fields.

Relation of vascular content to number, size and density of pulmonic markings.

Relation of heart shape to valvular defects.

Analysis of thorax picture—Scheme for Roentgenological study of the chest

1. Pulmonic fields.
 - Shape—triangular, rounded, irregular.
 - Size—height, width; equal, unequal; large, medium, small.
 - Illumination—bright, brilliant, deficient, absent; general, local; location, borders; sharp (concave, convex, horizontal), indefinite, mobile, immobile.
 - Expansion—equal, unequal, diminished.
2. Hilum shadows.
 - Shape.
 - Size.
 - Structure.
 - Density.
 - Calcification.
 - Pulsation.
3. Pulmonic markings.
 - Number.
 - Size.
 - Shape.
 - Extension.
 - Density.
 - Distribution—general, local.
4. Tracheal and bronchial outlines—air content.
 - Trachea—size, shape, position, bifurcation (site).
 - Main bronchi.
 - Relation to hilum shadow.
 - Relation to aortic arch.
5. Diaphragm.
 - Position (relative).
 - Shape.
 - Contour—regular, irregular, concave, wavy; convex, billowy.
 - Movement.
6. Vertebra, ribs and spaces.
 - Structure.
 - Direction.
 - Width.
7. Cotodiaphragmatic space.
 - Size.
 - Shape.
 - Illumination.

8. Median shadow.

Outline—left aorta, pulmonary artery, left auricle, left ventricle, right auricle, right aorta.

Size—small, normal, large.

M. R.—Maximum deviation of the heart shadow to right of median line.

M. L.—Maximum deviation of heart shadow to left of median line.

T.—Total heart width = M. R. + M. L.

P.—Total pneumonic field radius.

L.—Heart length, "apex to base."

V.—Angle of ventricular line to horizontal = 45° .

Position—normal, transposed, displaced.

Axis—vertical, oblique, transverse.

Shape—normal, spherical, oval, triangular, rectangular.

Movements—as a whole, its individual chambers, the great vessels.

9. Aorta.

Size—small, normal, large; length from junction of right auricle to summit of arcus; width at base, at arcus.

Shape—ascending, arcus, descending.

Position.

Density.

Movement.

10. Upper mediastinal shadow.

Size.

Shape.

Outline.

Position.

Tracheal position.

11. Retrosternal space.

Size.

Shape.

Illumination.

12. Retrocardia space.

Calcification.

Shadows.

13. Esophagus.

Pathological findings.

Interpretation.

Diagnosis.

METHOD OF REPORT

A radiographic examination of the chest gives the following results.

The pulmonic fields are of $\left\{ \begin{smallmatrix} \text{even} \\ \text{uneven} \end{smallmatrix} \right\}$ size, the $\left\{ \begin{smallmatrix} \text{right} \\ \text{left} \end{smallmatrix} \right\}$ being $\left\{ \begin{smallmatrix} \text{larger} \\ \text{smaller} \end{smallmatrix} \right\}$ and of $\left\{ \begin{smallmatrix} \text{even} \\ \text{uneven} \end{smallmatrix} \right\}$ illumination, the $\left\{ \begin{smallmatrix} \text{right} \\ \text{left} \end{smallmatrix} \right\}$ being deficient in illuminations in its $\left\{ \begin{smallmatrix} \text{middle} \\ \text{upper} \\ \text{lower} \end{smallmatrix} \right\}$ part.

The pulmonic markings $\left\{ \begin{smallmatrix} \text{are} \\ \text{are not} \end{smallmatrix} \right\}$ increased in $\left\{ \begin{smallmatrix} \text{number} \\ \text{density} \end{smallmatrix} \right\}$ in the entire part of the field.

The markings $\left\{ \begin{smallmatrix} \text{are} \\ \text{are not} \end{smallmatrix} \right\}$ confluent. There is an obliteration of the pulmonic markings and illumination over an area bounded by ribs. This is $\left\{ \begin{smallmatrix} \text{even} \\ \text{uneven} \end{smallmatrix} \right\}$ in its distribution.

The costophrenic space is $\left\{ \begin{smallmatrix} \text{well illuminated.} \\ \text{obscured.} \end{smallmatrix} \right\}$

The median shadow is $\left\{ \begin{smallmatrix} \text{distorted} \\ \text{normal} \end{smallmatrix} \right\}$ displaced $\left\{ \begin{smallmatrix} \text{downward.} \\ \text{upward.} \\ \text{right.} \\ \text{left.} \end{smallmatrix} \right\}$

The diaphragmatic outlines are $\left\{ \begin{array}{l} \text{visible} \\ \text{invisible} \\ \text{regular} \\ \text{irregular} \end{array} \right\}$ defined $\left\{ \begin{array}{l} \text{sharply} \\ \text{not sharply} \end{array} \right\}$ and in $\left\{ \begin{array}{l} \text{normal} \\ \text{abnormal} \end{array} \right\}$ relation to each other, the $\left\{ \begin{array}{l} \text{left} \\ \text{right} \end{array} \right\}$ being higher.

The pathological findings are -----

This would indicate the presence of -----

LECTURE VI

Localization of foreign bodies:

Principles and general methods.

Plate localization.

Fluoroscopic localization.

Stereoscopic localization.

Localization of foreign bodies in the eye.

Practical lessons

Lesson I.—A demonstration of laboratory organization: Equipment; units; laboratory routine; radiographic technique.

Lesson II.—Fluoroscopy: Advantages; disadvantages; ray quality and quantity; screen under suspension; sensitization of the eye; protective measures—operator, patient; limits of safety.

Manipulative procedures—palpation—magnification.

Study of bony system: Chest; gastrointestinal tract.

Placing the patient in postures, positions.

Demonstration of the causes of distortion and how to obviate them.

Lesson III.—Fractures, upper extremities. Reports of cases by students according to scheme outlined, these reports being subjected to general criticism and comment.

Lesson IV.—Fractures, lower extremities.

Lesson V.—Study of the head and spine, normal and pathological: Suture markings; vascular markings; air sinuses; sella turcica.

Study of air or gas in soft tissues—detection—localization.

Lesson VI.—Study of osteomyelitis. Reports of cases by students on the basis of scheme outlined, these reports subjected to general criticism and comment.

Lesson VII.—Study of differential diagnosis of inflammatory bone diseases from syphilis, tumor, and systemic bone conditions.

Lesson VIII.—Study of chest conditions—pneumothorax, effusions, consolidations.

Lesson IX.—Localization of foreign bodies. Practical demonstration.

MAYO CLINIC, ROCHESTER, MINN.

The courses of instruction in war surgery at the Mayo Clinic, Rochester, Minn., for officers and other Medical Department personnel, included the officers' school of general and war surgery; courses of instruction in anesthesia for nurses; courses of instruction for enlisted men for operating-room assistants. The courses were begun in November, 1917,¹⁷ and were discontinued in the spring of 1919.¹⁸ As originally planned, the courses were to extend over a period four weeks,¹⁹ but this was soon changed, and the later courses covered a period of six weeks.²⁰ An outline of the course extending from December 9, 1918, to January 18, 1919, follows:²¹

ANNOUNCEMENT

Class was divided into six sections. Sections were required to follow schedule. Members of sections required to report on work assigned.

St. Mary's Hospital.—General and special surgical and pathological clinics were given every morning; orthopedic surgery, Thursday morning; neurological surgery, Saturday morning.

Colonial Hospital.—Orthopedic surgery, every morning except Monday and Thursday; ear, nose, and throat surgery, every morning; plastic and oral surgery; general surgery, every afternoon.

Mayo Clinic Building.—Genitourinary clinic, second floor, every morning, 8.30 o'clock; eye, ear, nose, throat, and oral surgery clinic, second floor; orthopedic department, annex, clinical laboratory, second floor, experimental laboratory, fifth floor, Roentgenology clinic, second floor, every afternoon.

OUTLINE OF COURSE FOR SIX WEEKS

St. Mary's Hospital:	Hours
Surgical and pathological clinics.....	136
Colonial Hospital:	
Surgical and pathological clinics.....	76
Orthopedic surgery.....	
Eye, ear, nose, and throat surgery.....	
Mayo Clinic Building:	
X-ray clinics.....	3
Genitourinary.....	6
Experimental laboratory.....	6
Clinical laboratory.....	3
Eye, ear, nose, and throat clinics.....	6
Orthopedic clinics.....	6
Lectures.....	39
	69
Total.....	281

The classes and demonstrations were conducted by the staff of the Mayo Clinic, most of whom were members of the Officers' Reserve Corps, on the inactive list, receiving no salary from the Government. Thirteen classes and a total of 226 officers received instruction at the clinic.²⁰

In addition to the officers who were given instruction in the Mayo Clinic, classes of enlisted men were ordered there for training as operating room orderlies and classes of nurses were trained there as anesthetists.²⁰ Five classes of enlisted men, totaling 116, took the course.²⁰ The first course began in April, 1918, and was completed on June 5.²² A noncommissioned officer was detailed to the director of the school as his assistant in looking after the details of the clothing, subsistence, etc., of the enlisted men.²²

The following is a copy of the schedule of instruction given the enlisted men:²⁰

SCHEDULE OF LECTURES AND PRACTICAL DEMONSTRATIONS FOR THE ENLISTED MEN
(OCTOBER 21 TO NOVEMBER 29, 1918)

Practical anatomy and physiology (3 lectures—Monday, October 21, October 28, November 4, 1918).

- (1) Bone and muscles.
- (2) Blood and central nervous system.
- (3) Internal organs; position and formation.

Report at St. Mary's Hospital lecture room, 4 p. m.; sections A and B.

Practical hygiene (3 lectures—Monday November 11, November 18, November 25, 1918).

Report at St. Mary's Hospital lecture room, 4 p. m.; sections A and B.

Bandaging (3 lectures—Tuesday, October 22, October 29, November 5, 1918).

Each private required to learn to make the following: 1 circular, 2 oblique, 3 spiral reverse, spica of finger, spica of thumb, construct a sling, figure-of-eight for knee and elbow, Barton bandage, four-tail bandage for head.

Report at St. Mary's Hospital lecture room, 4 p. m.; section A.

Bandaging (3 lectures—Tuesday, November 12, November 19, November 26, 1918).

(Same as shown above for section A.)

Report at St. Mary's Hospital lecture room, 4 p. m.; section B.

Dressing of wounds (3 lectures—Tuesday, October 22, October 29, November 5, 1918).

(1) Types of wounds, burns, and frost bites.

(2) Immediate treatment; antitetanic serum, control of hemorrhage, cleansing of wounds, first-aid dressings.

(3) Drainage; antiseptics, dressings, special care.

Report at Desk C-b, Mayo Clinic, 4 p. m.; section B.

Dressing of wounds (3 lectures—Tuesday, November 12, November 19, November 26, 1918).

(Same as section B, shown above.)

Report at Desk C-b, Mayo Clinic, 4 p. m.; section A.

Sepsis and antisepsis (4 lectures—Wednesday, October 23, October 30, November 6, November 13, 1918).

Report at St. Mary's Hospital lecture room, 4 p. m.; sections A and B.

Usages of common drugs (2 lectures—Wednesday, November 20, November 27, 1918).

Description, dosage, demonstration of the following: Sedatives—Morphine, codine, heroin, aspirin, bromide, veronal. Stimulants—Ammonia, aromatic spirits; camphorated oil, atropin, coffee, digitalis. Cathartics—Castor oil, licorice powder, pills, etc.

Report at St. Mary's Hospital lecture room, 4 p. m.; sections A and B.

Operating room technique—sisters, anesthetists, surgeons (6 lectures—Thursday, October 24, October 31, November 7, November 14, November 21, November 28, 1918).

(1) Importance of hospital to the sick; lifting a patient on cart; dressing and undressing patient; how to give a patient water and food; temperature, baths, urinal; how to assist; disinfectants; bedpan; enemata; bed making.

(2) Asepsis; sterilization (*a*) scrubbing, (*b*) boiling and steam, (*c*) antiseptics; practical demonstration of preparation of sponges, pack, and salts, and sterilization of the same.

(3) Lecture 15 minutes on the care and sterilization of instruments; familiarization of instruments.

(4) Care and sterilization of ligatures; contents of emergency kit; Red Cross hospital supplies; review of instruments.

(5) Operating-room technique: (*a*) Care of sterile instruments and supplies; (*b*) preparation of surgical assistants; (*c*) preparation of patient; (*d*) anesthetics.

(6) Mock operation with review of operating-room technique.

Report at St. Mary's Hospital operating rooms, 4 p. m.; sections A and B.

Discussion of gas poisoning, drowning, shock (section A—Friday, October 25, November 1, November 8, 1918; section B—Friday, November 15, November 22, November 29, 1918).

Report at St. Mary's Hospital operating rooms, 4 p. m.

Demonstration of blood transfusion, intravenous saline, hypodermoclysis (section B—Friday, October 25, November 1, November 8, 1918; section A—Friday, November 15, November 22, November 29, 1918).

Report to Colonial operating rooms, 4 p. m.

Use of splints and plaster of Paris casts (9 lectures—section A, Monday, October 21, October 28, November 4, 1918; Wednesday, October 23, October 30, November 6, 1918; Friday, October 25, November 1, November 8, 1918. Section B, Monday, November 11, November 18, November 25, 1918; Wednesday, November 13, November 20, November 27, 1918; Friday, November 15, November 22, November 29, 1918).

Report at desk E1, Mayo Clinic, 7 p. m.

Technique in genitourinary preparation, (6 lectures—section B, Tuesday, October 22, October 29, November 5, 1918; Thursday, October 24, October 31, November 7, 1918. Section A, Tuesday, November 12, November 19, November 26, 1918; Thursday, November 14, November 21, November 28, 1918).

Report at desk A², Mayo Clinic, 7 p. m.

NOTE.—At the end of the course, each man was given a written and an oral examination.

The classes in the course in anesthesia were conducted for nurses beginning in April, 1918. Twenty nurses were trained in this work. The following is a copy of the schedule of instruction in anesthesia:²⁰

LECTURES

1. *Circulation*.—The course, purpose, and mechanism of the circulation of the blood. The physiological significance of blood pressure, the pulse, etc. The importance of this to anesthesia.

2. *Respiration*.—The purpose and mechanism of respiration. The physiological change that takes place in the lungs, etc. Relation of respiration to etherization.

3. *The nerve mechanism* in connection with the circulation and respiration. The nerve control of the circulation and respiration. How etherization modifies this.

4. *Physiology of anesthesia*.—Effect of the anesthetic upon blood pressure and respiration. The different stages of anesthesia.

5. *Physiological compensation during anesthesia*.—The adaptation of the anesthetic to the surgical procedure.

6. *Accidents occurring during anesthesia*.—Overetherization, shock, hemorrhage, etc.

7. Quiz.

DEMONSTRATIONS

1. A graphic study of the circulation and respiration. Attempts were made to demonstrate all of the important points emphasized in the first four lectures.

2. A study of the accidents occurring during anesthesia and the methods of combating them.

DIVISION OF GENERAL SURGERY

(a) Practical work:

1. Each nurse had five general anesthetics under the supervision of the regular anesthetist.
2. Practical demonstrations each day.
3. Ether by the drop method.
4. Induction; maintenance.

(b) Respiration and circulation during maintenance:

1. Complications during induction.
2. Complications during maintenance.
3. Artificial respiration; demonstrations.

(c) Blood pressure:

1. General principles and theoretical considerations.
2. Practical demonstration.

(d) Quiz.

SCHOOLS OF PLASTIC AND ORAL SURGERY

It became apparent to the Surgeon General, in July, 1917, that there was at his command an inadequate number of general and dental surgeons sufficiently experienced in plastic and oral surgery to take care of the cases of maxillofacial injuries that we were likely to encounter.²³ He planned, therefore, to secure the services of surgeons of the highest type and of considerable experience in plastic and bone surgery, and also of qualified dental surgeons, and to give both of these classes a course of instruction in plastic and oral surgery,

conducted by qualified instructors. These surgeons and dentists were to work and be trained together so that units, to be composed of a surgeon and a dental surgeon, could be formed which would give to the patients to be treated the skill of the two professions. The Surgeon General accordingly authorized the establishment of three medical schools to give special courses of instruction in plastic and oral surgery for officers assigned to that work.

Letters were then sent, through the Council of National Defense, to more than 200 prominent surgeons in the United States, to more than 800 teachers in dental colleges, and to other prominent dental surgeons, asking for suggestions as to individual men whose training and practice were such as to make them especially fitted for plastic and oral surgery.²³ In this way a long list was obtained to whom questionnaires and letters of inquiry were sent. Students for the schools were selected in the main, after a careful study of the answers to these questionnaires and letters. An advisory board, consisting of five prominent surgeons was called to meet with the subsection of the section of plastic and oral surgery, Surgeon General's Office, September 6, 1917, and it was decided at this meeting to open the first school in St. Louis.²³ The medical and dental departments of Washington University, St. Louis, offered their facilities unrestrictedly to the Surgeon General, without charge for the materials used. Two other schools were later established, one at the University of Pennsylvania, Philadelphia, and the other at Northwestern University, Chicago, Ill.²⁴

The schools were under the control of the Surgeon General, who designated the teaching staff and outlined the curriculum. The courses of instruction varied from 16 days to 4 weeks, and extended from October 15, 1917, to March 30, 1918.²³ All assignments of students were made from the Surgeon General's Office, after first making satisfactory arrangements with each student by correspondence or conference. Reports of efficiency and class standing were made to the Surgeon General at the close of each course and many reports and recommendations were unofficially made to the chief of the section in the Surgeon General's Office. In this way it was possible to obtain a very fair knowledge of each man's ability and qualifications at the end of his course of instruction.

It was customary, after the completion by these students of the courses of instruction, to assign a surgeon and a dental surgeon together to a base or evacuation hospital, the two composing a unit which constituted a division of the section of head surgery in the hospital. This unit, unless otherwise specified, had charge of injuries and surgical diseases of the mouth and its essential structures, including the bony framework and the soft tissues of the face, and also of the neck, with the exception of diseases and injuries that properly come under the specialties of ophthalmology, otolaryngology, neurologic surgery, and diseases of the thyroid gland. The instructors of the schools were selected from the staffs of the schools giving the courses and from the staffs of the affiliated institutions. Many of these institutions, as well as many of the students, were not on active duty and received no pay from the Government. Others were appointed contract surgeons, some of whom donated their pay to help defray the expenses of the courses of instruction. Following the plan inaugurated in the Chicago school, mimeographed copies of references to all obtainable

war literature were made and sent to the other schools in sufficient number to allow each student officer to have a complete copy. Students were required to furnish many of their own books. The schools were closed in March, 1918, the instruction being continued at the medical officers' training camps.^{23 25}

The numbers of officers who attended the courses in these schools were: Medical officers, 164; dental officers, 123.²⁶

Three courses were given in Philadelphia at the Thomas A. Evans Museum and Dental Institute of the School of Dentistry of the University of Pennsylvania, and the facilities of the following institutions were placed at the disposal of the director: Jefferson Medical College and Hospital; Medico-Chirurgical College and Hospital; Philadelphia General Hospital; Pennsylvania Hospital; Hahnemann Hospital; and Temple University.²⁷

The institutions affiliated with the Chicago school were as follows: Wesley, St. Lukes, Cook County, Presbyterian, Augustana, and Francis Willard Memorial Hospitals, and John Crerar Library. The teaching staffs of these schools were selected principally from the staff of the institutions in which the instruction was given and from the institutions associated with them. Two courses of instruction were given at the Chicago school.²⁸

The courses were similar in the three schools. The one conducted in St. Louis is given here as an example.

SCHOOL OF NEUROLOGICAL, PLASTIC, AND ORAL SURGERY, ST. LOUIS, MO.

This school was attended by surgeons and dentists, and courses in neurological surgery were given in conjunction with those in oral and plastic surgery beginning with the second course. During the first two weeks the morning sessions of the two groups were separate. Both groups together participated in the afternoon sessions. The courses occupied 16 working days, from 9 a. m. to 6 p. m.²⁹

SCOPE

- (a) To teach cooperation between surgeons and dentists.
- (b) To demonstrate the methods of immediate immobilization of mandibular fractures, the repair of soft parts with free drainage, the construction and use of emergency splints, and the care of complicating injuries.
- (c) To instruct in the treatment of face and oral injuries during the healing stage; repair of defects of bone and soft parts by plastic operations; construction of permanent prosthetic apparatus.

COURSES

Anatomy (51 hours); dentists attended the demonstrations only.

- (a) Dissection: Complete detailed dissection of head and neck by each surgeon (35 hours).
- (b) Demonstration daily reviewing the ground covered by that day's dissection.
- (c) Surgical anatomy of the head and neck emphasizing landmarks, surgically important structures, regions prone to harbor infections, surgical relations.

Numerous skulls, model dissections, and permanent specimens were at the disposal of the students.

Infective processes about mouth, face, and neck (7 hours).

- (a) Oral and dental infections: The recognition and treatment of diseases of the mouth and teeth, bacterial flora of the mouth, periodontal infection, their sequelae and influence upon injuries.

(b) Infections of soft tissues and bones: Erysipelas, traumatic and nontraumatic inflammation of the salivary glands, adjacent regions involved by infection, complications due to extension of inflammation (intracranial) thromboses, meningitis, edema of glottis, angina Ludovici, cervical infections, etc.

(c) Infections of maxillary antrum: Anatomy, diseases, symptoms, injuries, standard operations.

(d) Salivary infections and fistulae: Symptoms, treatment.

Fractures (4 hours).

The recognition and treatment of fractures of upper and lower jaw; surgical anatomy; importance of restoring dental occlusion; avoidance of deformity; complications noted in gunshot wounds; drainage of submaxillary region. The diagnosis and treatment was further illustrated in operative course "a." Treatment of temporomaxillary ankylosis.

Splints (7 hours).

(a) Demonstrations of the forms of temporary and permanent dental splints used for immobilization of mandibular fractures, special value of individual forms, selection of type to be employed.

(b) Demonstration; preparation of dental splints in presence of surgeons.

Operative course (27 hours); surgeons assisted by dentists.

(a) Plastic methods on the cadaver: Preliminary lectures preceded each day's laboratory work covering the operations to be performed that day. Students working in groups of three.

Repair of defects of the soft parts of the face by sliding and pedunculated flaps; reconstruction of lips and cheeks; repair of scar deformities of lips and eyelids; Thiersch and Wolff grafting; immobilization of fractured mandible by wiring of teeth; repair of gunshot defects of soft parts and bone with preparation of emergency splints; rib grafts; enucleation of eye.

Demonstration of repair of partial and complete loss of nose and ear by Indian and Italian method. Transplantation of finger to restore nose.

(b) Blood transfusion (3½ hours). Transfusion by citrate method performed on dogs by students in groups of four.

(c) Demonstration of bone grafting (3½ hours). Tibial graft transplanted into jaw defect of dog; technique.

Anesthesia (3 hours).

Lectures detailing precautions necessary and special technique. Insufflation intracheal ether anesthesia, local regional anesthesia (conduction anesthesia, peridental, etc.).

Postoperative care (4 hours).

Inspection of postoperative cases and wounds. Massage and mechanotherapy.

Röntgenology (2 hours).

Interpretation of radiographs showing dental and peridental abnormalities, fracture of jaws, foreign bodies, etc.

Clinical demonstrations (12 hours).

Varying with the material available, mainly consisting of fractured mandibles, operations for repair of defects of soft parts and scar contractures, cartilage and bone grafts, drainage of oral infections.

Extraction of teeth (4 hours). Demonstration.

Making and application of special forms of splints for the dentists (30 hours).

Each dentist constructed and retained for future reference the splints most applicable to the treatment of fractured mandibles. These exercises occupied the morning hours of the dentists for the first 10 days of the course.

At the completion of the first course the curriculum was changed and extended to include the following neurological surgery:²⁹

Neuropathology.

(a) Lectures and demonstrations (4 hours).

(b) Autopsies (6 hours).

Physiology of the nervous system; lectures and demonstrations (12 hours).

Clinical neurology.

(a) Lectures, dispensary, and ward work (23 hours).

(b) Eye and ear (7 hours).

This intensive course dealt in great detail with all aspects of the surgery of the soft and bony parts of the face, jaws, and neck, enabling both the surgeon and the dentist to grasp the manifold problems which would confront him from the time the recently wounded patient required his care to the final period of discharge. The present war surgery appeared to demonstrate that almost miraculous restoration of function and repair of hideous defects with but minor final disfigurement could be attained if the proper measures were immediately instituted and if the subsequent treatment were carried out according to well-defined principles. The course was designed to teach these fundamental and essential facts and to prepare the surgeon for their application in practice.

The first course began October 15, and the fourth, February 11, 1918. The first course covered a period of three weeks. The instruction in the second course for the dentists was completed on November 22, 1917, and instruction for the surgeons was completed on December 7; the later courses covered a period of four weeks. The expenses connected with the running of the school were handled by the Washington University and no bill was presented to the Government.²³

SCHOOL OF PLASTIC AND ORAL SURGERY, UNIVERSITY OF PENNSYLVANIA,
PHILADELPHIA, PA.

This school was conducted at the Thomas W. Evans Museum and Dental Institute of the School of Dentistry of the University of Pennsylvania.²³ A conference was held in the Surgeon General's Office on October 17, 1917, at which were representatives of the University of Pennsylvania and other medical schools and hospitals in Philadelphia and at this conference the course of instruction which had already been established in St. Louis was discussed, after which the facilities of the hospitals in Philadelphia were placed at the disposal of the Surgeon General, for the establishment of a similar course. A school at Philadelphia was authorized by the Surgeon General.²³ Three courses of instruction were completed at this school, the first session beginning November 5, 1917, the second on December 3, 1917, and the third on February 11, 1918.²⁴ The courses were attended by groups of surgeons and dentists, part of the course being arranged for both groups jointly, each group receiving instruction separately on subjects which pertained to that group.²⁴ The following is a synopsis of the courses given and the schedules of instruction by hours for each week in each course:²⁷

SYNOPSIS OF THE COURSE OF STUDY BEGINNING NOVEMBER 5, 1917

Anatomy:	Hours
(a) Dissections (surgeons).....	36
(b) Demonstrations (dentists).....	12
(c) Surgical anatomy lectures.....	4
Infectious processes about mouth, face and neck:	
(a) Mouth infection (bacteriology).....	4
(b) Infections of the neck and face—cellulitis.....	2
(c) Surgical infections of the face.....	1
(d) Infection and treatment of maxillary sinus.....	1
(e) Diseases of mouth.....	3
(f) Diagnosis and treatment of mouth diseases.....	1

Wounds and injuries; evening lectures.

Fractures:

(a) Diagnosis and treatment of old and new fractures.....	Hours 3
(b) Clinic on treatment of old fractures.....	1

Splints: Making and application of special forms:

(a) Lectures and demonstrations (surgeons and dentists).....	1
(Dentists only).....	2
(b) Laboratory work (dentists only).....	28
(c) Wiring, fractures.....	1
(d) Orthodontic bands for fractures.....	1

Operative surgery:

(a) Plastic methods on cadaver lectures and laboratory (surgeons only).....	24
(b) Bone and cartilage grafting on dogs (surgeons and dentists).....	12
(c) Blood transfusion.....	1

Anesthesia:

(a) General anesthesia (ether) }	1
(b) Intratracheal anesthesia }	
(c) Local anesthesia.....	7
(d) Nitrous-oxide and oxygen.....	1

Postoperative care:

(a) Carrel-Dakin method, demonstration and clinic.....	3
(b) Dental hemorrhage.....	1

Roentgenology:

(a) Symposium on dental X ray.....	3
(b) Location of foreign bodies with X ray.....	1

Clinical demonstrations:

Surgical clinics.....	2
Plastic operations on the face.....	2
Hospital clinics (to be announced).	

Extraction of the teeth:

(a) Difficult extractions.....	1
(b) Clinical demonstrations.....	3

Special lectures:

- Evacuation and transportation of the wounded.
- Removal of inspired bodies of a dental nature.

In addition to the facilities of the Evans Institute, lecture and demonstration rooms at the following institutions were at the disposal of the school:²⁷ Jefferson Medical College, Jefferson College Hospital, Medico-Chirurgical College, Medico-Chirurgical Hospital, Medical Laboratory Building, University of Pennsylvania, Philadelphia General Hospital, Pennsylvania Hospital, Temple University, and Hahnemann Hospital.

The instructors for the school were those serving on the staffs of the school and the above institutions.

The first dental course, beginning November 5, 1917, was attended by 17 surgeons, 14 dentists, and 1 bacteriologist; the second course, beginning December 3, 1917, by 16 surgeons and 16 dentists; the third course, beginning February 11, 1918, by 10 surgeons and 19 dentists.²⁶ Upon the completion of the course a report upon the ratings given each officer was forwarded the Surgeon General's Office.²⁶

NORTHWESTERN UNIVERSITY MEDICAL AND DENTAL SCHOOLS, CHICAGO, ILL.

This school was started November 19, 1917, and two courses of four weeks each were given. The following is a synopsis of the instruction:²⁸

SYNOPSIS OF COURSE

	Hours
Work of plastic and oral surgery division.....	1
Anatomy:	
Lectures.....	10
Dissections.....	30
Surgical anatomy and operative surgery:	
Surgical anatomy of the mouth, face, and jaws; cadaver.....	4
Ligation of vessels of the neck, tracheotomy, pharyngotomy, ankylosis of jaw, resection of upper and lower jaw; cadaver—	
Surgeons.....	8
Oral surgeons.....	4
Plastic surgery of the mouth, cheeks, and jaws; cadaver.....	2
Plastic surgery of the nose; cadaver.....	2
Plastics on skin and scars, suturing, transplautation of fat, etc.; cadaver.....	3
Bone and cartilage transplantation, nose and jaws.....	4
Infections and inflammations:	
Focal infections.....	1
Local, of mouth and jaws. Chronic alveolar infections.....	2
Infections involving neck, salivary glands, maxillary sinus (adenitis, cellulitis, glossitis).....	2
Bacteriology of mouth and jaw infections, gas gangrene, tetanus, etc.....	2
Treatment of acute infections of oral region; infections of maxillary sinus.....	1
Syphilis in the Army, and its treatment.....	1
Gunshot injuries and infections:	
Open wounds; injuries to trachea and larynx; physiological saline; Dakin-Carrel method, tincture of iodine, etc.....	2
Blood transfusion; its difficulties, technique of agglutination and hemolysis; laboratory work on dogs by members of the class.....	4
Blood tests in laboratory; blood transfusion.....	4
Foreign bodies in pharynx, trachea, esophagus.....	4
Fractures and dislocations of jaws:	
Treatment; prevention of deformities; lectures.....	3
Prosthetic restorations of nose and mouth parts.....	2
Splint construction (oral surgeons only).....	22
Demonstrations in connection with various clinics—anesthesia:	
General anesthesia; ether, nitrous-oxide and oxygen, rectal, intratracheal.....	2
Local.....	1
Demonstrations in connection with surgical clinics—Roentgenology:	
Lectures; reports of war work.....	2
Demonstrations in dental Roentgenology.....	1
Demonstrations of facial Roentgenology.....	1
Extraction of teeth—clinics.....	2
Clinics:	
Facial surgery.....	20
Oral surgery.....	2
General surgery.....	2
Special lectures on war experiences.....	4
Seminar.....	12

Literature on plastic and oral surgery, published since the war began, including many translations of French and German articles, divided into eight groups as follows: 1. Muscle and fat transplants. 2. Fractures. 3. Bone transplants. 4. Nose. 5. Skin and face

transplants. 6. Neck, larynx, salivary system, hemorrhage, nerve injuries. 7. Ankylosis, infection, injuries of cervical vertebra from the front. 8. Dental procedures.

Total time scheduled for surgeons, 156 hours.

Total time scheduled for oral surgeons, 159 hours.

The first course ended December 15, 1917. Thirty-two officers reported for this class. The second course began March 1, and ended March 30, 1918.²⁸

ARMY DENTAL SERVICE COURSE, NORTHWESTERN UNIVERSITY, CHICAGO, ILL.

In addition to the courses in plastic and oral surgery, the Northwestern University gave a postgraduate course of instruction during the month of February, 1918, called the "Army Dental Service Course."²⁸ Nineteen men took this course, the majority of whom held commissions in the Dental Corps. The course was given at the same time as the regular postgraduate course, and certain of the lectures and clinics were given to the two classes together, while others were separate.

The Army dental service course was planned with the object of giving to those who contemplated entering Army dental service, or who had already received commissions, a review of the field of Army oral surgery in order that they might be prepared to extend their work beyond that of routine Army dental service, as occasion might offer. The high percentage of injuries of the face and jaws called for a large number of men who were familiar with the surgery of those parts, and it was expected that a considerable number of dentists would eventually be placed in position as assistants to general surgeons in the care of these cases, the dentist making splints and prosthetic appliances for the restoration of lost parts. It was the purpose of this course to familiarize the dentist with this field so that he might be qualified to render the best possible service. The schedule for each course filled the hours from 8 a. m. to 5 p. m., and consisted, on the average, of two hours of lectures and six hours of clinics and demonstrations in the various departments each day.

The following schedule represents the course for dentists in splint making:²⁸

COURSE IN SPLINT MAKING BY DENTISTS

Friday, December 7, 1.30 to 4. p. m.—Draw and anneal German silver wire, 100 feet.

Take impressions from Babbitt metal models of case of fracture of the lower jaw, in region of cuspid. Make casts, reconstruct and mount on occluding frame. Wax up for Heath vulcanite splint; invest, pack, and vulcanize.

Monday, December 10, 1 to 4.30 p. m.—Take impressions from Babbitt metal models of case of fracture in region of both cuspids. Make casts, reconstruct and mount on occluding frame. Wax up for posterior band splint; invest, pack, and vulcanize.

Tuesday, December 11, 2 to 5 p. m.—Wire teeth of plaster models of upper and lower jaws (models to be supplied), using 30-gauge annealed German silver wire.

Wire teeth of plaster model of upper jaw to a 16-gauge German silver arch bar; wire teeth of lower jaw in same manner, then wire lower arch bar to upper bar.

Wednesday, December 12, 1 to 4.30 p. m.—Take impressions of upper model. Wax up model of splint with square brass tubing to the buccal of molar teeth on both sides. Invest, pack, and vulcanize. Then fit square brass rod into brass tubes and make wings to extend outside mouth to be supported by attachments to head cap.

Thursday, December 13, 8 to 11 a. m.—Take impressions from Babbitt metal models of case in which one half of the lower jaw is missing and mount on occluding frame with other half in proper relation to upper. Make German silver bands for two lower teeth with German silver flange attached on buccal side to hold lower jaw in proper relation to upper jaw.

Thursday, December 13, 2.30 to 5 p. m.—Finish and polish the vulcanite splints made on Monday, Tuesday, and Wednesday.

Friday, December 14, 8 to 12 a. m.—From Babbitt metal models of case in which anterior lower teeth and bone of chin have been lost take impressions of upper and separate impressions of the right and left lower teeth. Make casts and mount on occluding frame with lower teeth in proper relation to upper. Make German silver bands for two lower teeth on each side and connect with heavy arch to hold halves of lower jaw in proper place.

The second course of instruction began on March 1 and ended March 30, 1918. The schedule was similar to that of the first course.

The course was completed by 13 surgeons and 19 dentists. At the termination of the course the students were classified according to class standing, and reported to the Surgeon General as follows: Surgeons, class A, 6; class B, 6; C, 1. Dentists, class A, 8; class B, 8; class C, 3.

Affiliated institutions, the clinical material of which was available and used in the conduct of this course were: Wesley Hospital, St. Luke's Hospital, Cook County Hospital, Presbyterian Hospital, Augustana Hospital, Frances Willard Hospital, and John Crerar Library.

SCHOOLS OF ORTHOPEDIC SURGERY

After the original personnel of the division of military orthopedic surgery of the Surgeon General's Office was more or less automatically supplied and determined by the enrolling of the available trained orthopedic surgeons, it was quite apparent that this force must be considerably augmented as the demands upon its numbers increased. It was clear that the source of this supply must be found among the younger general surgeons and from a number of the many young practitioners who had already obtained acceptable training along surgical lines. In enrolling and recording the available orthopedic personnel the policy of the division was to depend entirely upon recommendations or personal applications for the first contact with the candidate. When such recommendation or application was received the person recommended or submitting the application was immediately reserved for orthopedic service. An effort was made to verify all statements concerning the experience and qualifications of the applicant and to decide as to his desirability and his adaptability. Those found desirable and available were transferred to this service. It was further evident that in addition to the elementary course in foot affections and care, splint work, and other orthopedic instruction, given at the Medical Officers' Training Camps at Camp Greenleaf and Fort Riley, it would be necessary to give to some of the younger surgeons special instruction in the fundamental principles of orthopedic surgery, in order to train them as assistants in hospitals to serve under qualified orthopedic surgeons. It was finally decided that intensive training in the larger medical centers was necessary.³⁰ In line with these views, early in September, 1917, arrangements were made with the postgraduate department of Harvard University³¹ and with the Post-Graduate Hospital, New York,³² to establish courses of instruction in these institutions, and a definite syllabus of this instruction was prepared. On October 15, 1917, arrangements were made for similar courses to be given in Philadelphia, Pa.³¹ Early in November a standardized course of instruction was determined upon,³³ which was used in all schools. The facilities of the

Army Medical School, Washington, D. C., were offered for special orthopedic instruction, and property adjoining the Army Medical School was leased for this special purpose.³⁴ About this time an orthopedic service was established at Walter Reed General Hospital, and the use of the wards and clinical material was offered in connection with the proposed course established officially through the approval of the Surgeon General.³⁵ The first class under this arrangement entered upon the course on November 12, 1917. Other schools were established, following the same plan and schedule of instruction at the following places: Oklahoma City, Okla.; Chicago, Ill.; and Los Angeles, Calif.³⁰

The teaching staff of these schools was composed of physicians, most of whom were not in the service.

HARVARD UNIVERSITY GRADUATE SCHOOL OF MEDICINE

Courses of instruction in orthopedic surgery which were given at the Harvard Medical School and the large hospitals in Boston began in September, 1917,³⁶ and continued until after the armistice, the last class beginning on November 1, 1918.³⁷ Several officers reported for the December class before it was decided to discontinue the regular courses, but arrangements were made to give them special instructions in orthopedic surgery.³⁸

The courses, as originally planned after the first trial course of four weeks, were intended to cover a period of six weeks,³⁹ but were extended to eight weeks in the winter of 1917-18, and were reduced again to one month in the summer of 1918, when the demand for orthopedic surgeons became more urgent.⁴⁰

The following instructions for the guidance of the students in their work in the schools, and in the rendering of reports, were issued by the Surgeon General, in April, 1918:⁴¹

INSTRUCTIONS TO MEDICAL OFFICERS ATTENDING COURSES OF INSTRUCTION IN ORTHOPEDIC SURGERY AT HARVARD GRADUATE SCHOOL OF MEDICINE

1. It is required that all necessary reports be promptly made out and forwarded through proper channels.

2. It is expected that all officers in attendance in this course will be prompt in attendance, and a report will be required in case of lateness or of absence.

3. A course being given in cooperation with a civilian institution, it is expected that the greatest possible care will be taken in relation to the laboratories, libraries, etc. This is particularly true as regards the anatomical department, where the observation of the following rules is imperative.

(a) Subjects must be kept covered when not in use, and steps taken to prevent drying.

(b) Subjects must be kept on blocks at all times to prevent maceration of dependent parts.

(c) Put seraps in the pail provided for that purpose.

(d) Greatest care must be used in handling frozen sections; these must not be dissected.

(e) Frozen sections must be returned to boxes in order after using.

(f) All material must be used with greatest care.

(g) Rooms must be kept clean and orderly at all times.

(h) The above rules will be strictly enforced.

4. The course is under military supervision and the usual formalities will be observed.

5. Inattention and lack of interest will be made a matter of record and forwarded to this office by those responsible for the instruction. Helpful suggestions regarding the conduct of the work will be appreciated and should be made subjects of communications which will be forwarded through the proper channels.

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The following is an abstract from a general outline of instruction, suggested by the Surgeon General, for use as a guide to those conducting the courses at these special schools:¹²

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This course includes instruction in the fundamentals of orthopedic surgery, particularly as related to the military service, including review of the correlated anatomy, particularly of joints, muscles, and nerves, and a course on brace making and fitting. The following general outline of this course suggests the scope of the instruction for those who have had general surgical training, but no special orthopedic training.

I. This course will be confined to work preparatory to assignment to reconstruction hospitals and will include:

- (1) Operative surgery, plaster, shop, and gymnasium.
- (2) Work in out-patient departments, and wards of large hospitals, supplemented by lectures bearing on reconstruction and plaster work.
- (3) Materials used in reconstruction work and their application, touching on making, keeping, handling, and application of plaster bandages.
 - a. Substratus of plaster, flannel, stockinet, and wadding.
 - b. Reinforcement of plaster casts with plaster, wood, wire, and iron.
 - c. Bracketing and making of removable dressings. Demonstrations of various methods of fixation; dressings allowing regular inspection of wounds.

II. Regional application of dressings, splints, braces, etc., to the spine and each of the joints with special reference paid to positions of fixation and methods to be used in the field hospitals.

III. Methods of mechanical control:

- (1) Immobilization in recumbency and ambulatory.
- (2) Compression, indications for—
 - a. Stilting.
 - b. Traction, methods for recumbent and ambulatory.
 - c. Permanent dressings for treatment after operations of bones, joints, muscles, and tendons, with attention paid to position of fixation, in various conditions.
 - d. Removable dressings to permit manipulation, massage and inspection, heliotherapy, etc.
 - e. Apparatus specially made for, and the improvization of apparatus for complicated conditions, and the mechanics of these forms of apparatus; special treatment of conditions and applications of apparatus and splints to the shoulder, elbow, wrist, hand, hip, knee, ankle, and foot.
 - f. Course in making removable dressings in plaster of Paris, cast splints improvised combinations of plaster, wire, steel rods, and wire gauze.

IV. Braces: Typical orthopedic braces made of leather, celluloid, aluminum, and combinations thereof, adhesive plaster strappings, and the conditions met by these; wadding dressings for restraining motion causing pressure.

V. Orthopedic operations:

- (1) Osteotomies, bone sutures, grafts, etc.
- (2) Joints, normal operations of joints such as excision and arthroplasty are not to be taught in this course on account of their extreme seriousness.
- (3) Muscles and tendons; tenotomy, tendon transplantation and tendon implantations, with the conditions indicating their employment will be taken up and the suture of nerves with the subsequent treatment and the cases of this character will be gone into.

VI. Manipulative Methods: Questions of forcible movements of joints to loosen adhesions and stretch shortened tissues will be taken up and for the most part condemned, with emphasis on precautions. Mechanics of reducing malunited and unreduced fractures without apparatus touched upon.

VII. Ward demonstrations which will have mostly to do with diagnosis and prognosis.

VIII. Physical therapy which will touch upon hyperemia by various kinds of heat, and other methods of obtaining hyperemia, massage, passive movements, resisted movements, etc., with a course in therapeutic exercises, hydrotherapy, electrotherapy, and heliotherapy. Special attention will be given to the indications for, and application of electrotherapy and hydrotherapy.

IX. Vocational reeducation: This course is planned with the idea of laying stress on kinds and percentages of disability, and ability on part of crippled men to perform certain occupations, and consideration of courses of instruction necessary for the reeducation of individuals disabled from military duty.

X. Special anatomy in relation to reconstruction work in orthopedic surgery will be given attention in addition to stress to be laid on the principles of orthopedic surgery.

XI. Principles and applications of hydro, and electro therapy; mechanical technique.

Upon the completion of this course, the officers will be detailed to the medical officers' training camps, for training in military hospital administration in a course already provided by the Surgeon General. From these camps the officers will be assigned as attending orthopedic surgeons to various Army training camps, to the United States hospitals, or for the special training in military orthopedic surgery in England, after which the officers may be transferred to France.

* * * * *

In addition to the intensive instruction in the fundamental principles of orthopedic surgery given at the above-mentioned institutions, some of the men who had attended the above courses, and others in small numbers, were given further instruction in orthopedic hospitals under orthopedic surgeons of experience, for the purpose of developing them for more specialized positions.³⁰

SCHOOLS OF NEUROSURGERY

On August 24, 1917, at a conference of the advisory board of the subsection of brain surgery, it was agreed that in order to carry out the Surgeon General's plan of having this subsection represented in each base, cantonment, and evacuation hospital, approximately 250 surgeons would be required,⁴³ and that in addition to these approximately 40 surgeons would be required for the proposed hospital for surgery of the head.⁴³ It was proposed, therefore, to establish definite schools of instruction for the special training of skilled surgeons in this particular branch of surgery. A committee was appointed to select locations for the schools and to outline the courses of instruction. Philadelphia, New York, Chicago, and St. Louis were selected as locations for the schools.⁴³

The courses of instruction included anatomy and physiology of the nervous system, clinical studies, and a careful survey of the literature of brain surgery for the period of the war to date.⁴³ The first course was begun in the University of Pennsylvania on September 17, 1917, and extended over a period of four weeks. At a meeting of prominent neurological surgeons in the Surgeon General's Office, on October 5, 1917, it was recommended that the course of instruction be extended to three months for the following reasons:⁴⁴

(1) The small number of available trained neurological surgeons; (2) the present course of four weeks in progress at the University of Pennsylvania had aroused the interest of the neurological surgeons sufficiently to cause them to take further instruction in neurology; (3) the intensive training given in the first four weeks with emphasis upon neuroanatomy, physiology, and symptomatology of diseases of the nervous system furnishes an excellent foundation upon which to build a more thorough knowledge of neurology; (4) Surgeons classified in the division of brain surgery are not needed in France at this time, and it seems advisable to

have them continue in active service, furthering their knowledge of neurology. It is also recommended that these surgeons be assigned to military camps for the necessary military instruction; (5) to prepare a group of brain surgeons by October 1 for the proposed neurological schools in the war zone. It is further recommended that this clinical instruction be carried on under the direction of a member of the class who shall be designated as director and whose duty it shall be to assign, with the cooperation of this office, to the different neurological clinics of a given city, as many men as can be instructed. It is suggested that the hospitals for the care of chronic neurological diseases, neurological divisions of out-patients departments, large accident wards, etc., be considered the chief source of clinical material.

It is also recommended that large neurological laboratories be supplied with men capable of special training in this line, so that the division might have listed a number of surgeons capable of caring for neurological material in the laboratories.

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It is further recommended that this plan be instituted in Philadelphia at the completion of the present course at the University of Pennsylvania on October 13.

These recommendations were approved by the chief of the section of surgery of the head on October 18, 1917, and schools were organized in the cities mentioned.⁴⁴ Letters were sent to directors of all hospital units to nominate candidates for these courses. The directors were given to understand that the candidates would be returned to their units on completion of the course of instruction, or in case the units were ordered overseas prior to the completion of the course. The courses were later changed to cover a period of 10 weeks.

After the directors of the schools had been appointed, letters were written by the chief of the division of head surgery to the leading hospitals and universities of the cities in which the schools were located, requesting their cooperation and assistance in the operation of the schools.⁴⁵ Letters were written to the commanding officers of military officers' training camps, cantonments, base, evacuation, and post hospitals, asking for nominations to take the courses of instruction in these schools. The student body was made up of selections from those nominated from these organizations, together with nominees in civil life, commissioned in the Medical Reserve Corps and ordered direct to the schools.⁴⁶ Adjutants were selected from the student body to assist the director in the preparation of returns, reports, etc.⁴⁶

These neurosurgical schools were administered with the sole object of training medical officers to approach neurosurgical problems from the standpoint of the neurological surgeon, and to develop in them habits of neurological thought, so that they would be able to interpret symptoms and apply their knowledge to the neurosurgical problems which they were certain to encounter whether in a cantonment, base or evacuation hospital, or in a first-aid dressing station. For this purpose the neurological surgery of civil life was presented from both the neurological and the operative sides. To this was added much of traumatic surgery of the central and peripheral nervous system which was derived partly from the material in civil and partly from that in Army hospitals. The attempt was made to give the student officers sufficient training to make them able to recognize the nature of an injury to the nervous system, to determine the location of the injury and to decide upon the indications for or contra-indications to operative treatment. The technique of operative treatment was considered in special surgical lectures and was demonstrated on the cadaver and on the living patient in the operating room, and special attention was paid

to the latest principles of treatment of brain, spinal cord, and peripheral nerve injuries that were reported from the war zones. The courses were planned to give the officers, through lectures and clinical demonstrations, by the individual study of the anatomy, histology, and pathology of the nervous system on the cadaver and through the microscope, a thorough knowledge of the anatomy and physiology of the nervous system, followed by lectures, demonstrations, and individual clinical work in neurology, neurosurgery, and in the essentials of ophthalmology, otology, psychiatry, and Roentgenology with which the neurosurgeon should be acquainted. In all the teaching, this aim was kept constantly in the foreground. It was clearly recognized, also, that the actual practical training could be obtained only from experience and work at the front.

It was not always possible to assign each group of officers to the school at the beginning of each session; at times the exigencies of the service made it necessary to assign officers to the school a number of weeks after a session had begun.⁴⁷ The courses were so arranged, however, that officers who had come late continued their studies in the succeeding course, so that they obtained a complete training of 10 weeks, just as if they had been present from the beginning of a session. During the intervals between sessions there were operative clinics and clinical demonstrations in some of the schools, so that the time of the officers who were held over from one session to the next was fully occupied.

Although subservient to the professional aims of the courses, the military duties and responsibilities of the officers were kept before them in most of the schools through regular systematic military drill and setting-up exercises and the explanation of the more familiar and usual official forms and regulations.

The school conducted at the University of Pennsylvania, as stated, was the first to be organized. The outline of the course of instruction given in this school is selected as typical of the work conducted in the other neurosurgical schools.

SCHOOL OF NEUROLOGICAL SURGERY, UNIVERSITY HOSPITAL, PHILADELPHIA, PA.

This school was organized in compliance with instructions from the Surgeon General of the Army.⁴³ The first course of instruction began on September 17, 1917, and terminated on October 22, 1917. The number of students taking the first course was 32. The second course began on October 23, 1917, and was completed December 29, 1917. It was composed of 27 students. The third course began on January 7, 1918, and was completed March 16, 1918, 25 in attendance.

COURSE OF TRAINING FOR NEUROLOGICAL SURGEONS, UNIVERSITY OF PENNSYLVANIA SCHOOL⁴⁸

The instruction will be divided into three groups: (a) Didaetic course; (b) laboratory course; (c) clinical course.

They should comprise the following groups: (a) Anatomy; (b) physiology; (c) pathology; (d) operative surgery on the cadaver; (e) animal surgery; (f) clinical neurology; (g) operating room technique.

It is estimated that by intensive work the course can be covered in four weeks, divided as follows: Morning (1½ hours)—anatomy, 15 lectures; physiology, 9 lectures; operative surgery, cadaver, 14 lectures; pathology, 6 lectures; animal surgery, 4 lectures. After-

noon (1½ hours)—clinical neurology, lantern slides, lectures, and assignments. (The remainder of the afternoon to be given up to presentation of cases in various hospitals.)

The various courses will cover, in general, the following:

(a) Anatomy: Scalp, skull, brain, with its various sections and the tracts in general. Subarachnoid space, circulation of the cerebrospinal fluid. The vertebral column. The cord with its segments and the plexuses and nerves. The circulation of the brain and cord.

(b) Physiology: Contemplates the complete discussion of localization, reflexes, nerve degenerations, and stimulations, etc.

(c) Pathology: (1) gross, a consideration of hemorrhage, abscess formation in the brain with the presentation of material demonstrating and emphasizing localization; method of the preservation of material; cord and spinal column, presentations of fracture and dislocations of the discussion of concussion, contusions, hemorrhage, etc. (2) Microscopic studies of nerve injuries and nerve repair.

(d) Operative surgery on the cadaver: This course in a combined didactic and laboratory course, one-half hour to be given to discussion of technique and one hour to operations on the cadaver, covering the following: Scalp wounds, clean and infected; osteoplastic flaps and treatment of hemorrhage and fracture; technique of decompression, dual incisions; brain puncture; ventricular puncture; brain exploration; dural closure; scalp closure; bone transplant; fascial transplants; fungus, cerebri; foreign bodies; technique of lumbar puncture, technique of laminectomy.

(e) Animal surgery: Consisting of operations on the dog; of nerve suture, brain hemostasis, laminectomy.

(f) Clinical neurology: This course is carried on by the aid of neurologists, consisting of lectures, lantern slides discussions, demonstrations of patients, covering the following: Methods of examination and history writing, the spinal fluid localization of foreign bodies, neurologic and X ray.

Diagnosis: Symptomatology and treatment, brain hemorrhage, concussion, fractures of the skull, abscess of the brain, meningitis, gunshot injuries of the brain and cord, fracture of the spine, cord injury, complete and incomplete nerve injury.

In connection with this course use will be made of the material collected by Major Tarnowsky and Major Seelig who are working on collection of literature of the war.

(g) Operating room technique and presentation of patients.

This outline was followed during the first course of four weeks, but was elaborated for the succeeding courses, which were extended in duration and in work.

The following method of classifying the students at the close of the course was employed: Group 1, those competent to operate, themselves, in neurological work. Group 2, those useful as assistants. Group 3, those suitable for assignment to courses of instruction in cantonment hospitals. Group 4, those not eligible for any of the above groups.

NEUROLOGICAL SCHOOL, PRESBYTERIAN HOSPITAL AND ALLIED INSTITUTIONS,
CHICAGO, ILL.

Two courses of instruction were given at this school.^{44 49} The first course began on November 1, 1917, and terminated on January 11, 1918.⁵⁰ The number of students in the class was 27. On completion of the course the students were ordered to the following camps: Bowie, Beauregard, Doniphan, Hancock, Lee, Logan, MacArthur, Sevier, Shelby, Taylor, Fort Oglethorpe, and Fort Riley. From November 1 to November 23, inclusive, the course consisted of lectures and laboratory work given at the University of Chicago. From November 24, 1917, to January 11, 1918, inclusive, the work was chiefly clinical and was given at the Presbyterian Hospital, Cook County Hospital,

and St. Luke's Hospital. In addition to this, pathological demonstrations were made in the pathological laboratory; operative surgery on the cadaver was done in the anatomical laboratory of Rush Medical College, and post-mortem examinations were held in the Cook County morgue. Once a week a seminar was held by the members of the class.

The second course of instruction began on January 15, 1918, and was terminated on March 25, 1918.⁵¹ The instruction was similar to that given in the first course. Eleven students composed the second class, and upon the completion of the course they were ordered to the following camps: Bowie, Cody Custer, Grant, Lee, MacArthur, Pike, Sherman, and Travis.

NEUROSURGICAL SCHOOL, NEW YORK CITY

This school, which was the largest of the neurosurgical schools, was organized at the Neurological Institute, New York City. The following hospitals and colleges in New York City cooperated in the organization of the school:⁴⁷ The Presbyterian Hospital; Roosevelt Hospital; New York Hospital; St. Luke's Hospital; Mount Sinai Hospital; Bellevue and allied hospitals; Columbia University; College of Physicians and Surgeons, New York University; and Bellevue Hospital Medical School.

Five courses were held as follows: First, December 3, 1917, to February 8, 1918; second, February 18, 1918, to April 26, 1918; third, May 6, 1918, to July 13, 1918; fourth, July 29, 1918, to October 5, 1918; fifth, October 14 to December 21, 1918.⁵² The first class was composed of 25 students; the second, 30; the third, 19 new men and 7 who remained over from the previous class for further instruction; the fourth, 25; and the fifth, 19.

The method of classifying the students at the completion of the courses of instruction was as follows: Two groups were formed: (*a*) Those capable of doing independent neurosurgical work; (*b*) those fitted for assistants. Each group was again divided: A+ meaning first class and A- meaning not quite so good; B+ meaning those who, under a certain amount of guidance, might be able to do good independent work; B- representing men who were fitted to act only as assistants.

COURSE OF INSTRUCTION IN NEUROSURGERY IN THE SCHOOL OF NEUROLOGICAL, PLASTIC, AND ORAL SURGERY, ST. LOUIS, MO.

One course of instruction in neurosurgery was given to a class of 36 students beginning November 3, 1917, and extending over a period of five weeks.²⁹ This course was given by the same instructors and at the same time that the second course in oral and plastic surgery was given in this school (see *Schools of Plastic and Oral Surgery*, p. 531). The following is a synopsis of the course in neurosurgery:

THE OBJECTIVE

I. To teach the correct interpretation of neuropathic symptoms: (*a*) As presented in shell shock; (*b*) in injuries to the brain and spinal cord; (*c*) in the early detection of cerebral hemorrhage and hemorrhage into the spinal cord; (*d*) the proper methods of eliciting reflexes and the differentiation of organic from functional nervous conditions; (*e*) the Bárány tests as an aid in the localization of intraeranian lesions; (*f*) the diagnostic value of the relation of intracranial pressure to general arterial pressure.

II. Head surgery: (a) The proper care of fractures of the skull and spinal column; (b) the advantages of early relief of pressure in hemorrhage into the brain and cord; (c) the dangers of permanent destruction of the nervous elements of the brain and cord incident to edema and hemorrhage; (d) the demonstration of operations designed to relieve pressure; namely, trephining, decompression, and laminectomy; (e) the care of the dura and the prevention of meningeal infection.

COURSE

Neuropathology (10 hours): (a) Lectures and demonstrations (4 hours), showing pathological brains and several specimens showing the effects of accidental injuries. Brain abscess, hydrocephalus internal and external, and brain tumors were considered in detail, with a full elucidation of the underlying principles of stimulation of the respiration by the intravenous use of hydrocyanic acid. (b) Autopsies (6 hours).

Anatomy of the nervous system (10 hours): Course covered a complete and detailed dissection of the brain and spinal cord tracts.

Physiology of the nervous system (12 hours): (a) Lectures and demonstrations upon the dog with the necessary instruments of precision, showing the relation of intracranial pressure to the general arterial pressure and the blood supply to the vital centers of the brain and accounting for some of the phenomena which accompany fractures of the skull and injuries to the brain and spinal cord. (b) Detailed description of the motor and sensory pathways of the spinal cord and internal structure of the brain.

Clinical neurology (78 hours): (a) Lectures, dispensary work, and ward walks (18 hours), going over brain and cord lesions, demonstrating reflexes, and tracing the motor and sensory paths. (b) Examination and diagnosis of new cases in the dispensary (16 hours). (c) A full discussion of the post-traumatic neuroses, and the differential points between Jacksonian and idiopathic epilepsy. (d) Operative clinics, showing the technic of operations, namely, trephining, resection of the Gasserian ganglion, three laminectomies, one after injury, suture of the ulnar nerve, lumbar and ventricular puncture in hydrocephalus, tumor of the pituitary, subsellar and suboccipital decompression, the use of acacia and sodium bicarbonate in the treatment of shock, and the arrest of hemorrhage by the use of bone wax and fresh muscle (44 hours). (e) Demonstration of craniocerebral topography on the monkey. (f) Student officers performed in the laboratory—trephining, decompression and osteoplastic decompression on the cadaver, and decompression and laminectomy on the dog.

Eye and ear (14 hours): (a) Demonstration of all the various methods employed in testing hearing. (b) The Bárány tests of the vestibular apparatus in relation to the diagnosis of intracranial lesions discussed fully in lectures and in dispensary. A thorough exposition of the clinical significance of the eye-pull, past pointing with both arms and trunk, and of spontaneous and induced vertigo, together with the technic of application of the tests was given. Class divided into sections to insure individual instruction in the technique of the work (7 hours). (c) Examination of the eye by direct and indirect ophthalmoscopy, with particular stress laid on the recognition of incipient choked disk, differential diagnosis between choked disk and optic neuritis, optic atrophy, and other pathologic eye grounds. Variations in intraocular tension from disease or injury were fully discussed (7 hours).

The seminar (14 hours): All references pertaining to this course in French, German, and English, taken from the list issued by the Surgeon General's Office, read, briefed, and reported upon at seminar. Also the book, *War Surgery of the Nervous System*, was divided into sections and reported by the student officers at the seminar.

Résumé: This intensive course deals with the all important subject of fractures of the skull and spinal column and the brain and cord lesions incidental to the same. As the writers on these subjects, who are working in the war zones, give many conflicting views and have set down certain facts which are really modifications of former principles of surgery, such modifications being due to circumstances incidental to warfare, it has been necessary in this course to reconcile divergent opinions expressed and to accentuate the accepted teaching on the following mooted points: (1) The indications and contraindications for the removal of fragments of bone, missiles, and other foreign substance from the brain. (2) The indications and contraindications for immediate surgical interference, the question of early closure of wounds not contaminated, and the prevention of sepsis. (3) The contraindications for drainage of brain

tissue, the correct method of drainage where the indications are absolute for same, and the prevention of hernia cerebri. (4) The indications for sufficiently prolonged care at the evacuation hospital and the extreme contraindications for moving of head cases. (5) The indications and contraindications for lumbar puncture in head injuries.

SCHOOLS OF MILITARY ROENTGENOLOGY

At the time the United States entered the World War, little preparation had been made for the use of the X ray in the Army under war-time conditions, and the number of qualified Roentgenologists available for service in the Army was inadequate for the contemplated needs.⁵³ The American Roentgen Ray Society had realized these facts for some time previous to the declaration of war, and a committee on preparedness had been appointed by the society for the purpose of studying the problem and outlining the action to be taken in case the United States was drawn into the war. Through the activities of this committee a list of the practicing Roentgenologists in the United States was compiled and considerable correspondence and propaganda were carried on for the purpose of interesting Roentgenologists, in civil practice throughout the country, in the military service. A canvass of the United States revealed the fact there were in the United States at the beginning of hostilities less than 300 trained Roentgenologists, and of really expert men probably not more than 100. It was recognized, therefore, that the problem must be solved by the institution of training having a scope broad enough to produce the necessary number of Roentgenologists sufficiently trained to do military Roentgenology, and of inducing medical men in sufficient numbers to enter the service with a view to their training as military Roentgenologists.

Soon after the United States entered the war the Surgeon General assigned a specialist in Roentgenology to his office and placed him in charge of all X-ray activities of the office.⁵⁴ In order to meet the problems mentioned above, this officer, in cooperation with the committee on preparedness of the American Roentgen Ray Society, immediately took under consideration and completed arrangements for the establishment of a central school of Roentgenology at Cornell University Medical College, New York City, with sections in Boston Mass.; Philadelphia, Pa.; Baltimore, Md.; Richmond, Va.; Pittsburgh, Pa.; Chicago, Ill.; Kansas City, Mo.; and Los Angeles, Calif.⁵⁵ These schools were placed under the direct control of the War Department and the trained Roentgenologists in charge of them were commissioned in the Officers' Reserve Corps.⁵⁶ Student officers in groups of 10 were assigned to the various schools. Upon the completion of the courses of instruction those destined for foreign service were ordered to New York for final examination and further instruction before any were ordered overseas, and others were ordered to camps and hospitals in the United States.

The curriculum decided upon was tentative, it being realized that it was impossible to attempt to provide Roentgenologists with broad training and extensive clinical experience in any reasonable length of time. It was decided, therefore, to concentrate the teaching upon the essentials, both physical and medical, so that the students would be well grounded in the physics of radiant energy; familiar with the apparatus for the production thereof and its troubles and the remedies to be applied; skilled and well trained in the essential methods

of localization of foreign bodies in the human anatomy, and the methods for transferring such information to the surgeon; and having as much experience as it was possible to obtain in the short time allotted in the diagnosis of fractures, dislocations, and human pathology other than surgical. It was further decided that the exigencies of the situation would not permit of a longer period of instruction than three months, to be followed by a short post-graduate course in the school at New York, to be devoted to a review of localization methods and machine instruction.⁵⁷

The course of instruction, which was both didactic and practical, embraced the following subjects:⁵⁷ (1) Roentgen physic; (2) practical working knowledge of all types of X-ray apparatus, including wiring of machines, trouble finding, and charting transformers; (3) principles and use of both gas and Coolidge X-ray tubes; (4) use of the fluoroscope; (5) construction and outfitting of a dark room as well as developing and other necessary dark-room technique; (6) plate making, including both exposure time and position of patient for various types of examination; (7) Roentgen anatomy; (8) interpretation of plates, including the normal, variation from the normal, and pathological conditions; (9) systematic record keeping, including marking of plates, recording interpretation of same, as well as the method of imparting this information in a short, concise, intelligent manner to the surgeon; (10) localization of foreign bodies by all approved methods; (11) handling of patients in a rapid, efficient manner.

Instruction began in June, 1917, and by September 1, all the schools were in operation.⁵⁷ These schools continued in operation until the early part of the year 1918, the last school, with the exception of the one in New York, closing March 1, 1918. The number of officers given instruction in these schools, with the exception of the New York school, averaged between 25 and 30.⁵⁸

The main object of the school, during the latter part of its existence, was the completion of the preliminary training given at the schools at Fort Riley and Camp Greenleaf.⁵⁷

The following is a summary of the personnel who received instruction at the New York school:⁵⁹

Officers of the Medical Corps (regular course).....	244
Officers of the Medical Corps (2 weeks course).....	58
Officers of the Sanitary Corps.....	23
Enlisted men, Medical Department.....	75
Officers of the United States Navy and Public Health Service.....	11
Supplementary course of instruction to Roentgenologists of experience.....	11
Total.....	422

SCHOOL OF MILITARY ROENTGENOLOGY, CORNELL UNIVERSITY MEDICAL COLLEGE,
NEW YORK CITY

This school was opened June 9, 1917.⁵⁹ In June, 1918, it was partially dismantled, much of the apparatus being sent to the Medical Officers' Training Camp, Camp Greenleaf, for use in its school of military Roentgenology. The teaching force, likewise, was greatly depleted, its members being ordered to overseas service, or to Camp Greenleaf, to assist in the conduct of that school

of military Roentgenology.⁶ It continued, however, to carry on instruction in methods of localization, and to provide clinical experience in the various New York hospitals for men awaiting orders at the port of embarkation.⁶ In the fall of 1918, when a great shortage of Roentgenologists suddenly arose, due to the unexpected call for an increased number of hospitals for overseas service, the capacity of the New York school was augmented for the purpose of assisting in meeting this emergency.⁶⁰ The school was finally closed January 21, 1919.⁶¹

Quarters for the school were tendered gratuitously by Cornell University Medical College;⁵⁹ the transformers, Roentgenoscopes, tubes, stands, and other apparatus were supplied, without cost to the Government, by the manufacturers;⁵⁷ the facilities of the Edward N. Gibbs Memorial X-ray Laboratory, University and Bellevue Medical College, were placed at the command of the Surgeon General for use in connection with the school,⁵⁹ and clinical facilities were offered by the various hospitals of the city.⁵⁷

SCHOOLS OF UROLOGY AND DERMATOLOGY

The number of men with adequate training in urological surgery, venereal diseases, dermatology, and syphilis was found to be insufficient for meeting the needs in base hospitals and the large camps. It was decided, therefore, to create opportunities for the younger men who might elect to do so to receive post graduate instruction in these subjects. To this end, schools for medical officers were established, in the autumn of 1917, in New York, at Columbia University, in conjunction with Vanderbilt Clinic; in Boston, at Harvard Medical School, in conjunction with Massachusetts General Hospital and Peter Bent Brigham Hospital; in St. Louis, Mo., at Washington University Medical School, with clinics at St. Louis City Hospital, Barnes Hospital, and Barnard Skin and Cancer Hospital.⁶² These schools were discontinued in the spring of 1918, all instruction in urology and dermatology being concentrated at the Medical Officers' Training Camp, Camp Greenleaf, Fort Oglethorpe, Ga.⁶³

The courses were intended to cover a period of four weeks, and this applied to the first, but the second and third courses were extended to cover a period of six weeks each.⁶⁴

Approximately 85 officers were detailed to take the courses.⁶⁵

The following syllabus of instruction of the course given at the Boston school, from February 1 to March 15, 1918, represents the scope of the instruction given the other schools:⁶⁶

SYLLABUS—INTENSIVE COURSE IN DERMATOLOGY, SYPHILIS, AND GENITOURINARY DISEASES A. DERMATOLOGY

(Monday, Wednesday, Friday, 9 to 12 a. m., Massachusetts General Hospital)

I. Lectures (11 hours): (1) The principles of dermatology; their practical application to diagnosis and treatment (anatomy, pathology, etiology, physiology).

(2) Common diseases—inflammations (eczema, urticaria, dermatitis, d. calorica, d. venenata, d. artificialis (malinering)).

(3) Common diseases due to bacteria (impetigo, furunculosis, erysipelas, tuberculosis, anthrax).

(4) Common diseases due to parasites (pediculosis, scabies, ringworm of groins, straw itch).

(5) Common diseases—infectious, contagious (the exanthemata).

(6) Diseases of the foot—affecting efficiency (hyperidrosis, clavus, callositas, verruca, pernio, erythromelalgia, and allied conditions causing pain).

(7) Systematic conditions and external manifestations (fatigue, toxemia, vasomotor disturbances, the kidneys, the digestive tract, disturbed metabolism).

II. Laboratory lectures and demonstrations (10 hours): (1) Pathological methods; pathological diagnosis (pathologist to Massachusetts General Hospital; 6 hours). The technique of obtaining, preserving, mounting, and staining; the microscope and its use; relationship of clinical signs and symptoms to the pathology; illustrations by demonstrations and by the exhibition of slides.

(2) Skin test methods (2 hours).

(3) How to use the pharmacopœia (2 hours). Exhibition of drugs and forms of external applications; demonstration of the value of the percentage column; emergency pharmacy, how to use what is at hand; practical pharmaceutical hints.

(4) The clinical use of the laboratory in daily practice. (In connection with the daily exercises in clinical work.)

III. Clinical lectures (16 hours): (1) On the topic of the lectures in I and II (5 hours).

(2) On the exanthemata—at Boston Hospital for Contagious Diseases (3½ hours).

(3) The relation of disease of the skin to systemic conditions (1 hour).

(4) The organization and conduct of a skin clinic (one-half hour).

(5) Organization, equipment, and conduct of a skin hospital (one-half hour).

(6) Nursing in diseases of the skin (1 hour).

(7) Dermatologic therapy—various (2 hours). (Light therapy; heliotherapy; hydrotherapy; radium; refrigeration; instruments.)

(8) Ward visits.

IV. Clinical work (15 hours): (1) In the out-patient department. History taking; notes and note making; methods of examination; diagnosis, laboratory work in the out-patient department; treatment of patients; the use of instruments and apparatus in treatment; practice as executive assistant; case study; research.

(2) In the ward. Observation of disease progress; studies in diet; in metabolism; case examinations; intensive study of assigned cases; preparation of case reports; records and record keeping; cytology, stool examinations; routine of the ward medical officer; experience in nursing; methods of application of treatment, dressings.

(3) In the daily use of notebooks. Records of each day's work and experiences; of each day's problems and questions; of suggestions received; of all matters of interest encountered; to be kept and to be used in directing home studies and in connection with all class exercises.

V. Class exercises (5 hours): (1) Conferences. For the presentation by the student to the class of prepared case reports and for the demonstration of the cases reported.

(2) Colloquia. Held at intervals, for the purpose of a general review of the course work, for the reading of notes taken, for the presentation of problems and for the asking of questions, for the purpose of a general, informal discussion of everything in which students and instructors may have opportunity to get closer together.

The plan of this course contemplates the acquisition of the greatest possible clinical experience by the student.

It is intended that the instructor shall lay a sure foundation by his lectures but shall otherwise interfere as little as possible.

Under the instructor's supervision, the student will perform all clinical and laboratory work himself, in every exercise, whenever possible.

That no problem may remain unsolved and that the inaccuracies of memory may not interfere, the student is expected to enter the facts in his notebook at the time and, later, to present them at the class exercises.

A series of colloquia has been provided for to which the student may bring his problems and questions for informal discussion.

These informal class meetings are expected to do much in smoothing the way for the student, in promoting interest and zeal and in bringing student and instructor to more intimate understanding.

The outcome depends upon the freedom with which the student utilizes the invitation and opportunity.

B. SYPHILIS

(Tuesday, Thursday, Saturday, 9 a. m. to 12 m.; Massachusetts General Hospital)

I. Lectures; clinics (26 hours): (1) Syphilis (6 hours).

(2) Eye syphilis (3 hours). Lecture; clinic.

(3) Bone syphilis; exhibition of museum specimens (1 hour).

(4) X-ray diagnosis (X-ray department, Massachusetts General Hospital; 5 hours).

Demonstration of methods; of diagnosis; clinics.

(5) Syphilis in surgery (1 hour).

(6) Syphilis of the throat (3 hours). Clinical lecture and demonstration of cases.

(7) Syphilis of the ear (3 hours). Clinical lecture and demonstration of cases.

(8) Visceral syphilis (1 hour).

(9) Syphilis of the spinal cavity (3 hours). Lecture and demonstration of spinal puncture and injection.

II. Laboratory exercises (6 hours): (1) The microscope in diagnosis (4 hours). (a) Dark-field microscopy; (b) staining of spirochaeta; (c) detection.

(2) The Wassermann test (Pathological laboratory of Massachusetts General Hospital; 2 hours).

III. Clinical exercises (16 hours): (1) Clinics (5 hours).

(2) Therapeutic clinic (3 hours).

(3) Salvarsan administration (5 hours).

(4) Diagnosis (3 hours).

All lectures on syphilis and on special topics will be fully illustrated by cases and clinics.

The students will be afforded every opportunity for studying disease manifestations, for diagnosis and treatment, for the laboratory detection of the spirochaetae and for the studying the Wassermann test by means of clinics and clinical work and by means of special laboratory exercises.

C. GENITOURINARY DISEASES

I. Lectures (30 hours): (1) Methods of examination; urinalysis.

(2) Ureteral instruments; asepsis and use.

(3) Cystoscopes; construction and use; urethral catheterization.

(4) Physiology of kidney; methods of estimating renal function; their importance and limitations.

(5) Acute gonorrhea.

(6) Chronic gonorrhea, prostatitis; vesiculitis.

(7) Treatment of gonorrhea.

(8) Stricture of urethra (2 hours).

(9) The prostate.

(10) Prostatism (2 hours).

(11) Renal infections (3 hours).

(12) Calculi, renal and ureteral; pyelography.

(13) Tuberculosis of bladder.

(14) Tuberculosis of genital tract.

(15) The kidney: Tumors, hydronephrosis, cysts.

(16) The kidney: Malformations; injuries; idiopathic hematuria.

(17) The bladder: Tumors, diverticulæ, malformations, wounds; result of spinal cord lesions.

(18) The scrotum and testes: Anomalies, inflammation, hydrocele, spermatocele, henatocele, tumors; vas and cord; vesicles.

(19) Penis: Malformations, tumors, phimosis, paraphimosis.

(20) Pain in genitourinary tract: Varieties and significance.

(21) Hematuria and pyuria.

(22) Major operations (4 hours).

II. Clinics (46 hours): (1) Out-patients' department; clinics (32 hours).

(2) Operative clinics (12 hours).

(3) Diagnosis and treatment—ward visit (2 hours).

III. Laboratory exercises (12 hours): (1) Test for urea in the blood; the phenolsulphonephthalein test (2 hours).

(2) Demonstration: The tubercle bacillus (2 hours).

(3) Methods of pyelography—X-ray department (2 hours).

(4) Bacteriology of the gonococcus (2 hours).

(5) Demonstration of gross and microscopic anatomy of the genitourinary system (4 hours).

IV. Class exercises (10 hours): (1) Weekly class meeting: Review of the work of the week, submission of notes and case reports, general colloquium, quiz (10 hours).

Throughout the course it was intended that the student should examine and treat the patients, under the supervision of the instructor; that he should assist at major operations, when possible; that he should become familiar with the use of the cystoscope, with the methods of diagnosis preceding operation, and with the laboratory diagnosis of venereal disease.

The lectures were fully illustrated by lantern slides and by pathological specimens from the laboratory of the hospital and from the Warren Museum of the Harvard Medical School.

SCHOOLS OF NEUROPSYCHIATRY

The opening of the large number of camps almost simultaneously, in the summer of 1917, created such a great demand for neuropsychiatrists that it was hardly possible to send them to military officers' training camps for preliminary military training. A few were ordered to these camps and in addition a few officers who were taking the regular course of training at the camp were accepted for neuropsychiatric service; and some neuropsychiatrists acquired their military knowledge by the actual performance of duty. These methods of training were obviously inadequate, and it was found desirable to provide additional professional instruction. This instruction was generally furnished by the directors of special medical institutions at the following institutions: Michigan Psychopathic Hospital, Ann Arbor, Mich.; Boston State Hospital; Neurological Institute, New York City; Philadelphia General Hospital; Phipps Psychiatric Clinic, Baltimore, Md.; Government Hospital for the Insane, Washington, D. C.; Manhattan State Hospital, New York City.⁶⁷ The directors in question, who were given the title of military director, were generally the superintendents of the institutions who had been commissioned in the Army, or who were serving under contract. The military directors secured the collaboration of many other professionally prominent and representative teachers, each within his respective vicinity.⁶⁷

The student officers ordered to these schools were on duty status and between two and three hundred were given this instruction.⁶⁷ Reports were made to the Surgeon General by the directors, on the progress of the work, qualifications, etc., of the students, and from these reports it appeared that about 20 per cent of the student officers could be considered as qualified in this specialty at the close of the courses. The most promising students proved to be those

who had been in active work for about 10 years rather than the recent graduates, or older men.

The courses were outlined and scheduled for six weeks in duration, although in some cases it was necessary to interrupt the instruction where the services of the student officers were urgently needed for actual military duty, while in some instances students were kept at the schools for longer periods.⁶⁷ Even when courses were not actually in progress, there were usually some students left on special detail to profit by the usual clinical routine of the institutions concerned. In this manner the officers had exceptional opportunities to perfect themselves in their specialties, and the Surgeon General had the advantage of obtaining information as to an individual officer's professional and personal qualifications before he was assigned to military duties. The course of study included lectures, clinics, demonstrations, and laboratory work. The fields covered were psychiatry, psychology, personality problems, serology, neurology, neuropathology, with collateral instruction in otology and ophthalmology.

COURSE IN NEUROLOGY AND PSYCHIATRY, POST-GRADUATE SCHOOL OF
NEUROLOGY, PHILADELPHIA, PA.

In planning the courses in neurology and psychiatry the Philadelphia School considered the amount of time which the exigencies of the service would allow to be devoted to the subject, and the rosters and schedules were prepared accordingly.⁶⁸ While it was realized that the instruction given in neurology should be, and was, largely clinical, it was deemed essential to give some didactic and semididactic instruction in neuroanatomy, neurophysiology, and neurological medicine. The outlines were planned, therefore, to include a limited amount of this work. Physiology of the nervous system, especially as concerns cerebral, spinal, and peripheral localization, received particular attention, and an effort was made to follow closely the anatomico-physiological teaching by the presentation of clinical cases illustrating the subjects taught. Organic neurology was taught by systematic demonstration of organic symptomatology, illustrated by cases which were made to cover a wide range. The Philadelphia General Hospital provided many cases of tabes and other forms of sclerosis, syringomyelia, organic hemiplegia and other organic nervous diseases, which were demonstrated. The differentiation of such conditions as hemorrhage, thrombosis, and embolism and their separation from focal lesions like tumors and abscesses were amply illustrated. Moving-picture demonstrations were sometimes used. Instruction in syphilis of the nervous system and epilepsy were emphasized. The morphological recognition of disordered glandular functions were taught through a study of both neighborhood and glandular symptomatology. Pathology of the cerebrospinal fluid and neurohistology were thoroughly gone into. Electrodiagnosis and electrotherapeutics were covered, including a description of the various forms of electrical apparatus. Reactions of degeneration were elucidated and illustrated, and the diagnostic differences shown by cerebral, spinal and peripheral lesions were exhibited by a study of cases of hemiplegia, monoplegia, meningomyelitis, poliomyelitis, and nerve injury. Close attention was given to those phases of ophthalmology which are associated with neurological work. Instruction in neurootology included, among other phases, detailed instruction in the Bárány tests.

The plan for the course of instruction in psychiatry was based on suggestions contained in Medical Department Circular No. 22, Office of the Surgeon General, Washington, D. C., dated August 1, 1917.^h However, the instruction given was not confined to those suggestions, and full advantage was taken of the very large and varied amount of clinical material available.

COURSES IN NEUROPSYCHIATRY, STATE PSYCHOPATHIC HOSPITAL, ANN ARBOR, MICH.

The course of instruction in neuropsychiatry at the State psychopathic hospital of the University of Michigan was attended by 77 officers of the Medical Corps.⁶⁹ The first officer reported on July 23, 1917. The course was in charge of the director of the State psychopathic hospital, who was employed as a contract surgeon in the Army. The instruction was organized so as to give the officers as practical an experience as possible and stress was laid upon the relation of the various subjects to problems of military medicine. It included instruction in: Psychiatry; neuropathology; neurology; ophthalmology; otology.

The following abstract of the courses given at the State psychopathic hospital, Ann Arbor, Mich., gives an idea of the scope of the work covered in these schools.⁶⁹

PSYCHIATRY

Psychiatric instruction was given at the Psychopathic Hospital and the following subjects were covered:⁶⁹

1. General survey of the problems of mental disorders in their military relations (2 hours).
2. Discussion of the organization for neuropsychiatric work; of the schemes and methods for diagnosis and recording of data (2 hours).
3. General psychopathology; didactic lectures, with clinical demonstration (10 hours).
4. The functional mental disorders of the present war; survey of the experiences published in the German, French, and British literature (4 hours).
5. Shell shock and the psychoneuroses (2 hours).
6. Psychoneuroses; neurasthenia; anxiety neuroses; hysteria; compulsion neuroses; didactic lecture and clinical demonstrations (4 hours).
7. Manic-depressive insanity; didactic lecture and clinical demonstrations (2 hours).
8. Dementia præcox; didactic lecture and clinical demonstrations (4 hours).
9. Syphilitic mental disorders; didactic lecture, clinical and anatomical demonstrations (4 hours).
10. Epileptic mental disorders; didactic lecture and clinical demonstrations (2 hours).
11. Psychopathic personalities; didactic lecture and clinical demonstrations (4 hours).
12. States of mental defectiveness (2 hours).
13. Feeble-mindedness and mental subnormalities; didactic lecture and clinical and anatomical demonstrations (2 hours).
14. Psychometric tests; didactic lecture and practical work in making examinations of defectives and delinquents (6 hours).
15. Mental disorders of organic brain diseases; arteriosclerotic mental disorders; mental disorders with tumors of the brain and brain injury; didactic lecture and clinical demonstrations (2 hours).
16. Serological diagnostic demonstrations; technique and interpretation (2 hours).
17. Attendance at the psychiatric clinic in the medical school at the university (1½ hours each week).
18. Practical work in study of cases and preparation of histories on the wards of the hospital.

^h See Vol. I, p. 940.

NEUROPATHOLOGY

A systematic course in the pathological anatomy of mental and nervous disorders was given. This course covered 14 periods of two hours each. The subjects covered in this course were as follows:⁶⁹

1. Embryological development of the central nervous system. Surface topography of the brain.
2. Study of gross fiber arrangements and ganglia of the brain.
3. Histology of the nerve cell; nerve fiber; neuroglia and cortical architecture.
4. Histology of the spinal cord.
5. Neuronic arrangements of the nervous system. Fiber paths.
6. Localization of nervous function; correlation of structure and function; diaschisis; theoretical consideration of aphasia and apraxia.
7. General pathology of the nervous system; malformations; diseases of the membranes of the nervous system; pathological changes in nerve cells; pathological changes in nerve fibers; secondary degeneration.
8. Inflammation, repair, and reactive processes in the nervous system.
9. Syphilis of the nervous system; gummatous formations; meningitis; vascular lesions; histological process of general paralysis.
10. Circulatory disorders of the nervous system; arteriosclerosis; hemorrhage; softening.
11. Tumors of the nervous system.
12. Pathology of the spinal cord; myelitis; poliomyelitis; progressive muscular atrophy; amyotrophic lateral sclerosis.
13. Tabes; Friedreich's ataxia.
14. Pernicious anemia; multiple sclerosis; syringomyelia; hydromyelia; peripheral neuritis.

Exercises 1, 2, 5, and 6 were carried on with brain dissections and demonstrations.⁶⁹ Exercises 3, 4, 6 to 14 were carried on with studies of microscopic preparations.

NEUROLOGY

The instruction in neurology was given in the neurologic wards of the hospital of the University of Michigan. The course was divided into three parts:

- a. A lecture course designed to cover the course systematically.
- b. Clinical demonstrations in which the officer was assigned to a case and allowed one hour to examine, his examination and conclusion being criticized by the instructor before the whole section, and free discussion was encouraged.
- c. A series of formal clinics in neurology, the same as given to the senior medical students in the University of Michigan, with special emphasis on the military aspects of the cases under discussion.

OUTLINE OF LECTURE COURSE

Methods of history taking and filling out of forms used in the neuropsychiatric service of the United States Army.

Technique of neurologic examination; demonstration; routine methods for rapid examinations of men for neurologic conditions (as abstracted from memorandum of instruction issued to examiners in neurology and psychiatry relative to preparation of statistical data, dated September 13, 1917).

Aphasia; hemiplegia; bulbar syndrome; Jackson's syndrome; epilepsy—idiopathic and Jacksonian; optic atrophy; Paraplegia.

Brain injuries—localization; brain abscess; brain tumor; hydrocephalus.

Cerebral arteriosclerosis; cerebral embolism, thrombosis, and hemorrhage; bulbar palsy; syphilis of the nervous system.

Spinal cord injuries—localization; myelitis—transverse and traumatic; poliomyelitis; spinal cord abscess; spinal cord tumor; syringomyelia; lateral and combined sclerosis; tabes dorsalis; pachymeningitis; herpes zoster.

Neuralgia; neuritis—diphtheritic, alcoholic, and nonalcoholic; injuries to nerves; facial palsy.

Meningitis—cerebrospinal, tuberculous, and other forms.

Endocrinopathies—adrenal, thyroid, pituitary, and ductless glands; Basedow's disease; vagotonia; myasthenia gravis; paralysis agitans.

Lumbago; sciatica; pes planus; migraine; chorea, ties; chronic progressive tremor; eye disease; ear disease; Menière's disease.

Progressive muscular atrophy (other hereditary diseases of the nervous system, unlisted).

Psychoneuroses—neurasthenia, hysteria, psychasthenia, and other forms.

Traumatic neurosis—effects on the nervous system of traumatism that does not produce demonstrable organic change.

General treatment principles—psychotherapy, rest, massage, intraspinal therapy, etc.

* * * * *

There were approximately 640 cases in the Neurological Clinic during the period of the course, all of which were available for study by the medical officers taking the instruction.⁶⁹

OPHTHALMOLOGY

The following subjects covered, with the aid of drawings, specimens, and anatomical models:⁶⁹

A

1. A review of the anatomy of the eye as an optical instrument.
2. Physiology of the accommodation and physiologic optics.
3. Anatomy and nerve supply and physiology of the eye muscles, with binocular vision and fusion and including the deep origin, relation and course of the third, fourth, and sixth nerves.
4. Muscular anomalies such as manifest and latent spastic strabismus, including heterophoria.
5. Diplopia and extraocular paralysis and nystagmus.
6. Nerve supply and physiology of the pupillary reflexes, including miosis, mydriasis, hippus and Argle-Robertson pupil.
7. Anatomy and physiology of the retina, optic nerve, chiasm, primary visual ganglia, optic tracts, and cortical visual centers.
8. Mechanism of production of choked disk and significance.

B

1. Diagnosis of optic neurosis and malingering.
2. The eye manifestations of wounds of the motor and sensory nerve of the eye and of the optic nerve, tracts, radiations, and centers.
3. Visual fields and hemiopia.
4. Eye symptoms produced by intracranial lesions, with particular reference to trauma.
5. Eye symptoms of brain tumor, meningitis, multiple sclerosis, myelitis, locomotor ataxia, superior poliomyelitis, general paralysis, exophthalmic goiter including the various signs associated with exophthalmic goiter, chorea, migraine, and herpes zoster of the eye.

OPHTHALMOSCOPY

1. Direct and indirect methods, including examination of the ocular media with the ophthalmoscope.
2. Ophthalmoscopic appearance of the fundus and the diagnosis of syphilitic, albuminuric, diabetic, leukemic lesions of the fundus and other lesions of the fundus dependent upon general diseases.

3. Differential diagnosis of ocular lesions of the choroid, retina, and the optic nerve, with especial reference to their differentiation from those lesions associated with general diseases.
4. Ophthalmoscopic appearance and diagnosis of glaucoma.

Throughout the whole course from one-third to one-half of the time was devoted to the study of cases with the ophthalmoscope, with demonstration of the ophthalmic changes peculiar to ocular and general diseases with especial reference to their practical differentiation.⁶⁹

OTOLOGY

A course of lectures and demonstrations of disorders of the ear in their neurological relations was given, the following subjects being covered:⁶⁹

1. Functional examination of the internal ear; disorders of the cochlear portion of the eighth nerve; vestibular nystagmus.
2. Tests for detecting simulation of deafness.
3. Diseases of the internal ear; Menière's disease; arteriosclerosis of the internal ear; injuries to the internal ear; syphilis of the internal ear; hysterical deafness; occupational deafness.

In general it may be stated that the plan as followed worked out quite satisfactorily. The chief difficulty was the marked difference in preparation and experiences of the men for taking such a course as given. Some had had no neurological or psychiatric experience and had little interest in the field. Others had had a limited experience as physicians in hospitals for the insane. In many instances this occurred in their early medical work, and since then their chief interests had been the general practice of medicine. A relatively small number had had a somewhat better than average experience in neurology or psychiatry.

As the time during the day that might have been utilized in work was fully occupied by the various courses of instruction, the matter of military training while attending the course was left largely to the interest and wishes of the majority in a group.⁶⁹ Some groups showed a certain amount of interest in this matter, and systematic courses of drill were carried on under supervision of officers attached to the Reserve Officers' Training Corps of the university. The problem of maintaining a military attitude on the part of the men was difficult. There was a marked difference on this among different groups. When there were several in the group who had been previously in training camps there was some effort on the part of the group to carry out a military behavior. In general it must be said that there was little effort at this institution toward maintaining more than the usual relations between teacher and pupil.

The enlisted personnel for nervous and mental cases was made up, as far as it was possible to obtain them, from attendants who had previous experience in State hospitals. They were assigned to neurology and psychiatry duty direct, in some cases by orders, when already enlisted, and in others they were inducted into the service and were sent first, as far as possible, to a training camp where they were given military training and later assigned to permanent psychiatric duty. This special class of experienced men was by no means sufficiently numerous to meet the demand, and was supplemented by men from the Medical Department at large. As few of these had previous special training, they were sent, when possible, for instruction to St. Elizabeths Hospital, Washington, D. C.

The nurses were also obtained in large part from the training schools of State hospitals, and these women nurses became members of the Army Nurse Corps. Special women assistants, termed psychiatric aides, were taken into the Army after a course of training at Smith and other colleges.

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CHAPTER VIII

MISCELLANEOUS SCHOOLS

SCHOOLS OF INSTRUCTION IN GAS DEFENSE

In May, 1917, the responsibility for the development and production of gas defensive appliances and material and the giving of instruction in their use and repair was definitely placed upon the Medical Department.¹ In order to train personnel for the technical and administrative phases of the work in gas-defense methods a central gas-defense school was established on August 20, 1918, in connection with the Infantry School of Musketry at Fort Sill, Okla.² The Adjutant General having selected and ordered to the school as instructors in gas defense three medical officers² whose names were among those of nine submitted by the Surgeon General.³ Other officers were subsequently ordered to the school for duty. In addition to officers and enlisted men from other branches of the service, detachments of medical officers, principally from the medical officers' training camps, were ordered there for courses of instruction, upon the completion of which they were ordered to the various divisional camps to be assigned as instructors in the camps and to divisions as division gas officers.⁴

This was the beginning, as far as the Medical Department was concerned, of training in gas defense. It led to the incorporation, by the Surgeon General, of the training section in the plans for the Gas Defense Service in his office, the duties of which were to provide instruction regarding the use of gas-defense appliances and the handling of gases used for training purposes, to train officers and men in the use of gas-sampling apparatus, gas detectors and other means of defense against gases, and to communicate the same to all concerned.⁵

By January, 1918, the divisional schools, having the advantage of complete equipment, and of advisers from the British Military Mission,⁶ were better prepared to carry on the instruction in gas defense than was the central school at Fort Sill; the school at Fort Sill, therefore, was discontinued as a central school on February 24, 1918.⁷

In addition to the gas-defense school at Fort Sill, a school was established at the American University, Washington, D. C., for the purpose of giving chemists of the field training section of the Gas Defense Service a course of instruction in gas-defense methods, these officers to be assigned to divisions as chemical advisers to the medical officers in charge of the gas schools.⁸ And on February 27, 1918, training in gas-defense methods was turned over to the Chief of Engineers.⁸

TRAINING SCHOOLS AT MEDICAL SUPPLY DEPOTS

The authorization of the Sanitary Corps in June, 1917,⁹ made it possible to obtain officers for duty as supply officers, purchasing agents, X-ray technicians, automobile and accountancy experts, etc., with the supply service, thereby providing the nucleus for the development of an adequate personnel.¹⁰

The camp medical supply depots developed at the several cantonments during 1917 proved most valuable assets, not only in the prompt and efficient furnishing of medical supplies to medical units at the camp, but, through training schools established in them, in the local training of enlisted and commissioned personnel in the nomenclature and the handling of medical supplies. The need for competent medical supply officers continued to increase and plans for training personnel were further developed. The enlisted personnel at the various camp supply depots who showed aptitude were promoted to the grades of noncommissioned officers. The best of these were selected and sent to the various training schools for medical supply officers. The principal schools were established at Newport News, Camp Meade, and Camp Upton.¹¹

An outline of instruction was proposed and carried into effect in these schools, covering the period from reveille to retreat. The training was necessarily very practical. Upon reporting for duty and instruction, the men were assigned to the various departments of the depot, that is, the receiving, issuing, and accounting departments, etc., and were carefully instructed in the details of the work pertaining to the department. They were changed from one department to another as experience and efficiency was gained. Lectures were outlined and given covering detachment work, accomplishment of forms, military correspondence, school of the soldier, courtesies of the service, etc.

The following is an example of the syllabus of instruction used in the camp medical supply depots:¹²

SYLLABUS OF LECTURES TO BE GIVEN BY CAMP MEDICAL SUPPLY OFFICERS

1. The supply tables:
 - (a) Classification of supplies.
 - (b) Nomenclature of supplies.
 - (c) Normal allowance of various Medical Department units (pars. 474-476 and 842-959, Manual for the Medical Department, 1916).
2. Requisitions (pars. 474-495).*
3. Transfer of medical supplies (pars. 496-500).*
4. Accountability (pars. 501-503).*
5. Distribution of field supplies in time of peace (pars. 504-506).*
6. Distribution in zone of advance (see Field Service Regulations).
7. Replenishment in combat (pars. 551-554 and par. 858).*
8. Returns of medical property (pars. 507-508).
9. Sales of medical property (pars. 509-510).
10. Distribution of medical property on abandonment of post (par. 511).*
11. Use and care of medical property (pars. 512-526).
12. Base medical supply depots (pars. 782-786).
13. The advance medical supply depot (pars. 787-792).

SCHOOLS FOR TRAINING IN MOTOR MAINTENANCE AND OPERATION

On December 8, 1917, the Surgeon General accepted the offer of the Carnegie Institute of Technology, Pittsburgh, Pa., to use the instruction facilities of the department of automobile mechanics in that institution in the training of medical officers and enlisted men of the Medical Department in maintenance and operation of motor vehicles.¹³ It was proposed to detail

* Figures refer to paragraphs in the Manual for the Medical Department, 1916.

approximately 4 classes, each consisting of 2 officers and 25 enlisted men selected from among those at training camps who had basic knowledge of gas-engine mechanics, in order that they might be given further intensive special instruction in maintenance and operation. The course was for one month. The policy adopted provided that officers and enlisted men who qualified as gas-engine experts would be assigned to motorized units of the sanitary trains serving with mobilized divisions. Instruction was largely practical, and comprised automobile mechanism, automobile repairing, ignition systems and practice in drawing and reading blue prints, "trouble shooting," finding defects for repair, and work in ignition laboratory. Students were observed during and examined upon completion of the course and graded in technical knowledge, originality and aptitude.¹⁴

Four sessions each for different classes were planned and conducted between January and June 27, 1918.¹⁵ Later arrangements were made for the training of several additional classes.¹⁵ Upon completion of their courses of instruction officers and enlisted men were assigned to motorized units of the Medical Department where, as instructors and consultants, they developed into valuable adjuncts in the training of personnel engaged in the operation and maintenance of motor vehicles.

The following is an example of a course of instruction given to a detachment of the Medical Corps in automobile maintenance and operation, at this institution, with subjects of instruction and hours allotted to each.¹⁶

	Hours
Automobile repair and machine-shop practice.....	39
Fundamental principles of electricity; lecture.....	12
Practical ignition work.....	27
Practical motor work and trouble shooting.....	40
Motor cycle and automobile driving.....	12
Acetylene welding; simple.....	16
Principles of mechanical drawing.....	12
Motor and chassis lecture.....	8
Examination, beginning.....	8
Examination, leaving.....	8
Total.....	186

Equipment used in motor laboratory.—One Packard truck motor, 1 standardized Army truck motor, 3-ton; 1 Dodge motor; 1 Ford motor; 1 Pierce-Arrow truck motor; 1 General Motors Co. truck; 1 large Continental motor; 1 Wisconsin motor as used on Garford 2-ton truck. All these motors were equipped with complete ignition and carburetor systems and with water and exhaust systems for running.

For ignition and carburetor work.—Bosche, Dixie, Eisman high-tension magnetos. Delco, Remy, and Standardized Army truck battery ignition systems. All representative types of carburetors used at the present time in the Army service, including the plain tube Stromberg, Marvel, Stewart, Rayfield, Schebler, etc.

Three tables were made for the purpose of showing the various ignition systems, and to allow the student to trace out and build up circuits, from the simplest to the most complicated.

For driving practice and chassis repair work.—One General Motors Co. $\frac{3}{4}$ -ton truck; 1 Ford truck; 1 White truck chassis; 1 Maxwell chassis; 1 Peerless chassis, and the use of 1 Dodge car for instruction 2 afternoons per week. For motor-cycle work 2 Indian motor-cycles with side car were available.

For general repair and machine-shop practice.—There were available work benches and vises, and for a small amount of machine-shop practice there were available lathes, arbor presses, and various other machine tools.

Description of various parts of instruction; automobile repair.—It was the intention to show the best methods of repair on various parts of the motor and chassis, without the use of complete hand and machine tool equipment. At the same time a small amount of time was given to the operation and handling of tools that would be found in a completely equipped shop.

Electricity lectures.—These were intended to present the subject of principles of electricity and magnetism in a brief manner and with special application to ignition systems. They were presented in simple form and illustrated by demonstration and lantern slides.

Practical ignition work.—In this work magnetos were disassembled and the various parts and circuits explained. The student actually performed this work himself, and assembled this magneto, made all adjustments, and placed it on the motor in proper time. The same process was repeated with a battery system of ignition.

Practical motor work and trouble shooting.—This consisted of removing the vital parts of one or two motors, fitting up bearings, timing valves, and getting the motor in good operation again. Emphasis was placed on the proper method of overhauling a motor and replacing all parts in proper manner without injury. Finally the motor was operated with water-cooled jackets and final adjustments made.

Trouble shooting consisted of systematic trouble finding. The motors were purposely placed with some manner of trouble on them and the student required to find and correct it. This was repeated until a list of the most important troubles with carburetor and ignition systems were shown and explained. Most experienced automobile men can locate trouble if given time, but few have adopted a system of elimination whereby trouble can be located quickly.

Motor cycle and auto truck driving.—This took only a small part of the time of the course and was intended to give those who were not familiar with driving of either motor cycle or truck a fair amount of practice in both. Practically all men of this detachment were good truck drivers, but some were not so good with the motor cycle. It was the intention to pick these out and make them more efficient in this part of the work.

Simple acetylene welding.—Twelve hours were given to the use of the acetylene flame and making simple welds of iron and other metals.

Drawing.—This was intended as a practical course to give the man a clearer idea regarding the conventions used in making a drawing so that he might be better able to read a blue print of an automobile chassis or motor, and be able to pick out the construction from such print.

Text book used to supplement lectures was Hobbs and Elliott's "Gasoline Automobile."

SCHOOLS FOR LABORATORY TECHNICIANS

The occurrence, in the fall of 1917, of large numbers of measles cases, with the resultant pneumonias and the occurrence of a considerable number of cases of meningitis, called for an increased number of trained personnel in the Army laboratories, and it became evident that the measures already taken for the training of laboratory personnel were not sufficient to meet this increased demand. Therefore with the assistance of the medical division of the National Research Council, schools were established and courses of instruction standardized for training women who were not experienced in medical work as laboratory technicians. The following is a list of the most important schools established for this instruction:¹⁷ Rockefeller Institute, New York, N. Y.; New York City Board of Health; New York State Laboratory, Albany, N. Y.; New York Post-Graduate Medical School and Hospital, New York City; Hunter College, New York City; Massachusetts Institute of Technology, Boston, Mass.; The Philadelphia Polyclinic and College, Philadelphia, Pa.;

The Woman's Medical College of Pennsylvania, Philadelphia, Pa.; Philadelphia Bureau of Health, Philadelphia, Pa.; University of Chicago, Chicago, Ill.; Illinois College, Jacksonville, Ill.; Ohio State University, Columbus, Ohio; Medical School, University of California, Berkeley, Calif., in cooperation with the George William Hooper Foundation for Medical Research.

The courses given in most of these schools were outlined by the Surgeon General, and were designed to train women in this country as laboratory technicians for duty in the base hospitals and other laboratories. Some of the schools included men as well as women. It was desirable that four types of technicians be available for work in the base hospitals; the first three to be women, the fourth to be men of the Sanitary Corps, whose training had otherwise been arranged for. The instruction was based on eight hours' work per day. The following is the outline of instruction sent to these schools, upon which the courses were bases:¹⁸

Class I. Clinical urinalysis, hematology, gastric analysis, feces. High-school girls of special ability or college graduates.....	1 month.
II. Preparation of sections and of media. High-school girls.....	1 month.
III. Bacteriology and Wassermann technique. College graduates who had had bacteriology.....	10 weeks.
IV. Quantitative analyses of urine and blood—metabolic work. Chemists who have had special courses.....	2 weeks.

At the completion of each course a list of the students was forwarded to the Surgeon General with an estimate of the type of work which each had performed. The method of grading was as follows: A = excellent; B = very good; C = probably not available for appointment without further training. Applicants from among those qualified were accepted in the laboratory division as civilian employees and sent to the various laboratories throughout the Army as needed.

On November 30, 1918, 398 female technicians were on duty in the United States Army Laboratory Service, practically all of whom had been trained in these schools.¹⁹

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- (5) Correspondence. Subject: Personnel for gas-defense service. On file, Record Room, S. G. O., 201948 (Old Files); also Weekly reports, field supply section, Gas Defense Service, S. G. O. On file, Weekly Report File, S. G. O.
- (6) Memorandum for the Chief of Staff from Col. D. W. Ketcham, war plans division, acting assistant chief of service, from acting director, W. P. D. A. A. C. of S., April 6, 1918. Subject: Gas training. On file, Chemical Warfare Service, 353.9 A. G. S. O. 3 C. W. S. 25375.

- (7) Letter from the commandant to the director of the training committee, General Staff, Washington, D. C., through the commanding general, Fort Sill, Okla. Subject: Weekly report of the Infantry School of Musketry for the week ending February 16, 1918. On file, Historical Section, Army War College, 7-25.3.
- (8) S. O. No. 48, W. D., February 27, 1918.
- (9) G. O. No. 80, W. D., June 30, 1917.
- (10) Monthly returns from medical supply depots to the Surgeon General. On file, Record Room, S. G. O., 319 (name of depot) M.
- (11) The Annual Report of the Surgeon General, U. S. Army, 1919, Vol. II, 1187.
- (12) Syllabus of instruction to be given by camp medical supply officers. On file, Historical Division, S. G. O.
- (13) Letter from Surgeon General of the United States Army, December 8, 1917, to Director, Carnegie Institute of Technology, Pittsburgh, Pa. Subject: Acceptance of offer of director to give training to medical officers and enlisted men in automobile maintenance and operation. On file, Record Room, S. G. O., 353 (Carnegie Institute).
- (14) Letter from president, Carnegie Institute of Technology, May 14, 1918, to Surgeon General. Subject: Further detachments for training in automobile maintenance and gas-engine operation. On file, Record Room, S. G. O., 353 (Carnegie Institute).
- (15) Letter from the Surgeon General, May 27, 1918, to the president, Carnegie Institute of Technology, Pittsburgh, Pa. Subject: Acceptance of offer for further detachments of officers and enlisted men for training in automobile maintenance, and expression of appreciation of department. On file, Record Room, S. G. O., 353 (Carnegie Institute).
- (16) Outline of courses of instruction given detachment of the Medical Corps, United States Army, in automobile maintenance and operation at Carnegie Institute of Technology. On file, Historical Division, S. G. O.
- (17) Correspondence on file in Record Room, S. G. O., 231 (Laboratory technicians).
- (18) Letter from Maj. F. R. Hill, M. C., to Col. F. F. Russell, M. C., May 7, 1918. Subject: Instruction of technicians. On file, Record Room, S. G. O., 231 (Laboratory technicians).
- (19) Annual Report of the Surgeon General, United States Army, 1919, Vol. II, 1042.

SECTION II
IN THE AMERICAN EXPEDITIONARY FORCES
CHAPTER IX
TRAINING PROJECT

Medical Department training, as well as the training of all other branches of the American Expeditionary Forces, was under the supervision and control of the training section of the general staff, general headquarters, A. E. F.¹ Therefore the scheme for training Medical Department troops conformed, at least at first, to the general program, which was based upon the organization of the American Expeditionary Forces. In this organization, a six-division corps was adopted.² Each corps was to have four combat divisions and two replacement divisions. One of these replacement divisions was to be established in some convenient training area behind the general position of the combat divisions.³ Its function was to hold and train replacements in officers and men of all grades for the first-line divisions. The sixth division, forming the second of the two replacement divisions, was to be called the depot division and to be stationed near the ports. This depot division was to receive drafts from the United States and give them little more than individual training. It was then to send these partially trained men to the replacement division for the completion of their training.

It proved impossible to carry out this replacement scheme; however, upon it was necessarily and conveniently hung the entire school system of the American Expeditionary Forces.³

The program referred to above was outlined by the chief of the training section, general staff, A. E. F., in the following memorandum:

HEADQUARTERS AMERICAN EXPEDITIONARY FORCES,
OFFICE OF THE CHIEF OF STAFF, TRAINING SECTION,
Paris, August 27, 1917.

Memorandum for the Chief of Staff.

Subject: School project for American Expeditionary Forces.

1. A study of the French and British systems of training of troops in France indicates that the following school project will best meet the needs of the American Army:

(a) In each division a system of troop training under the direct supervision of the division commander involving such incidental school instructions as may be desirable in the training of the division and for the purpose of producing instructors in corps schools.

(b) A center of instruction for each corps for the purpose of training the replacements of all grades and the commanders of all units. This naturally places the center of instruction at the location selected for the first replacement division of each corps and contemplates that each group of corps schools shall instruct commanders of proper grades for four combat divisions, assuming that the organization of corps recommended at these headquarters will be approved in full. Until the system is in complete operation it will also be necessary to train at corps schools a number of officers who will ultimately become instructors in Army schools.

(c) A center of instruction for the entire army in France, to be known as the army schools. This group should include a general staff college and such other schools as may be necessary to train instructors for all corps schools. The army schools should be under the direct control of these headquarters in order that the doctrine which should actuate the entire system of instruction and control our ideas of combat may be transmitted from the general staff through these schools to all units of the army.

As these schools will train a great number of men comparatively unfamiliar with actual operations, the group should be placed in contact with large bodies of troops. The necessity of economy of administration and uniformity of instruction require that the schools be grouped together so far as practicable. They should, however, be on or near the main lines of communication, close to the zone of the army, but far enough away from the front to be comparatively safe from hostile aircraft. They should be so located as to insure permanency, but not in such locality as to influence future action in regard to the front to be occupied. All of these conditions may be satisfied if the 2d Replacement Division of the First Corps, which would ordinarily be placed near one of the bases, on the west coast of France, were moved forward instead into a suitable division cantonnement, in the area bounded by Orleans—Montargis — Troyes — Chaumont — Langres — Gray — Dijon — Chalon — Nevers — Bourges—Issoudun—Blois. The various army schools should be so grouped with respect to the division as to permit the members of any or all of the schools to attend any or all of the demonstrations conducted by troops without in any way detaching troops for this purpose from divisions at the front, or in any way impairing the efficiency of troop training in the replacement division itself.

2. It will be impossible to put this system into complete operation until the entire First Corps has reached France. Under the present schedule of troops arrivals, this will occur about November 15 next. In the meantime it is necessary to meet the needs of army training as they arise and to utilize existing facilities to the best possible advantage. Thus the schools at Saumur and other points may be used for the training of the 2,200 reserve officers to reach France not later than September 15; Mailly may be used for our heavy artillery school; Arnouville-les-Gonesse may be used for the training of our antiaircraft guns, but these widely scattered schools should be regarded as expedients only and every effort should be made to bring all of our institutions for army training into close proximity, if possible, in the area above referred to, where the 2d Replacement Division of the First Corps should be located as already outlined.

It may be necessary to depart from this plan in some cases, but departure from the plan should be accepted only if compelled to by circumstances beyond our control.

3. Should it be found impracticable to concentrate the army schools and the 2d Replacement Division in the area named, then it is thought that both the division and the schools should be placed near one of the bases on the west coast of France. Should this be found impracticable, which is highly improbable, then it will be found necessary to locate the schools at a number of widely separated points. In order that the best possible solution may be secured, it is thought necessary to designate at once the prospective commandants of these schools, acquaint them with the situation and direct them to make the necessary study of the corresponding British and French schools and submit recommendation in regard to the organization, equipment, personnel, and curriculum best suited to our needs. While this work is in progress, the operations and training sections, working in cooperation and with the French General Staff should locate the exact area best suited for this work and take the necessary steps to place the schools and the division in the area selected.

(b) That the French Government be advised of the decision of these headquarters to place the 2d Replacement Division and the schools named in the area referred to and that the training section, in cooperation with the operations section, be authorized to take the necessary steps to accomplish the results desired.

(Signed) PAUL B. MALONE,
Lieutenant Colonel Infantry, D. O. L.,
Chief of Training Section.

SCHOOL PROJECT FOR AMERICAN EXPEDITIONARY FORCES

Per combat division: No schools—troop training.

Per army corps: Army corps center of instruction (located at 1st Replacement Division of each army corps and under supervision of division commander).

Object: (1) Training replacements; (2) training various commanders of all units, etc.

(A) TRAINING

1. Drafts of all arms received from base replacement division.
2. Training of men to be noncommissioned officers of all arms.

(B) ARMY CORPS SCHOOLS

1. The corps infantry school: Section A, platoon and section commanders; Section B, rifle company commanders; Section C, machine gun platoon and company commanders; Section D, trench mortar (3 inch Stokes and 37 mm.); Section E, lines of information.

2. The corps artillery school: Section A, Lieutenants and battery commanders (3 inch and 6 inch howitzers); Section B, instrument sergeants and range finders; Section C, lines of information (radio, telephone, and signal); Section D, artillery information, firing charts, sound ranging, flash ranging.

3. The corps engineer school: Section A, company and platoon commanders; Section B, sapper's school; Section C, pioneers' school (Engineers, Infantry, Cavalry, and Field Artillery).

4. The corps cavalry school: Section A, mounted service school. NOTE.—Captains and lieutenants attend Infantry and Engineer schools.

5. The corps gas school: For all arms of the service.

6. The corps signal school: Section A, company and platoon commanders; Section B, special noncommissioned officers.

7. The corps sanitary school: Ambulance and field hospital company officers.

8. The corps aeronautical school: Section A, combat aviation school; Section B, combat balloon school.

9. The corps field officers' school: All lieutenant colonels and majors (includes school course and visits to all schools).

ARMY SCHOOLS

Army schools (located at 2d Replacement Division of First Army Corps and under direct supervision of general headquarters).

Object: (1) Training instructors for corps schools; (2) Training special officers.

1. The general staff college, A. E. F.: Special officers selected for general staff work.

2. The army line schools, A. E. F.: Section A, Infantry lieutenants; Section B, Artillery lieutenants; Section C, Engineer lieutenants; Section D, Signal lieutenants (trained to include company and battery commanders duties). Section E, captains, majors, and lieutenant colonels of all arms; Section F, line of information (liaison of all arms); Section G, sanitary service.

3. The army candidates' school, A. E. F.: Training soldiers to be officers (if necessary to be divided into sections for each arm).

4. The army antiaircraft school, A. E. F.: Section A, Artillery; Section B, machine guns.

5. The army artillery school, A. E. F.: Section A, heavy artillery; Section B, trench artillery; Section C, railroad artillery.

6. The army signal school, A. E. F.: Section A, telegraph; Section B, telephone; Section C, radio; Section D, visual methods; Section E, system operations; Section F, carrier pigeons.

7. The army aeronautical schools, A. E. F.: Section A, aviation school; Section B, balloon school; Section C, Infantry and Artillery observers, organization and training.

8. The army sanitary school, A. E. F.: Complete outline to be announced later.

9. The army engineer school, A. E. F.: Section A, sapper's school; Section B, pioneer school for Engineers, Infantry, Cavalry, and Field Artillery; Section C, bridging; Section D, mining; Section E, searchlights; Section F, ranging; Section G, topography; Section H, camouflage.

10. The army Infantry specialists' center, A. E. F.: Section A, automatic weapon; Section B, musketry, bayonet, and sniping; Section C, grenade, trench mortar, 3-inch Stokes, and 37 mm.

11. The army center of information, A. E. F.: Conferences and demonstrations for all generals and colonels of all arms.

12. The army tank school, A. E. F.

13. The army gas school, A. E. F.

BASE TRAINING CENTERS

Army corps base training center (located at 2d Replacement Division of each army corps and under supervision of division commander).

Objects: (1) Training new drafts; (2) special classes of soldiers.

(a) Training: Training new drafts individually of all arms and services.

(b) Base training schools: Section A, cooks and bakers; Section B, clerks; Section C, mechanics; Section D, saddlers, horseshoers, and stable sergeants; Section E, drivers and packers; Section F, chauffeurs; Section G, telephone operators; Section H, telegraph and radio operators.

Thus training in its broader sense was to include the field training of troops, and schools to train officers as instructors, for command, and for special service.

FIELD TRAINING

Training in the American Expeditionary Forces was intended to complete the preliminary training given in the United States, and was planned to be given as follows:³ (1) One month's training in technique of the special service as required for the American Expeditionary Forces, conditions including terrain exercises and maneuvers in the open and trench operations in the training area for division, corps, and army troops; (2) one month's training in actual occupation of a quiet sector to inure troops to field and fire conditions and to test organizations and teamwork under stress; (3) one month's training in maneuvers and terrain exercises of open operations in training areas. In passing, it might be said that because of the pressing demand for troops for combat early in 1918, few divisions received the full period of three months' training in France.³

To economize in time of training after arrival in France, War Department was requested, in the fall of 1917, to send ahead of each division a staff officer familiar with training in the United States to report with previous schedules to G-5 headquarters, A. E. F. The training program for the first phase in France was to supplement and complete what had been done in the United States.³

Arrangements were also made with War Department by which each division should cause approximately one-third of its officers and noncommissioned officers to precede it to France long enough to go through one of the corps schools before the arrival of the division.³ These officers then were able to meet their divisions and give them the last thing in the development of methods and practice in France.

The following outline shows the amount of training it was contemplated that sanitary troops would receive during the three months' period referred to above:⁴

SCHEME OF TRAINING FOR SANITARY TROOPS

FIRST MONTH

First week:

For all sanitary troops of the division—	Hours
School of the soldier and squad-----	5
Personal hygiene; footgear, their fitting; trench feet-----	5
Duties of the soldier; Army and camp regulations-----	1
Military courtesy-----	1
Equipment of the soldier—responsibility and care-----	1
Organization of the Army-----	1
Materia medica and pharmacy-----	5
Anatomy and physiology-----	5
Organization and duties of the Medical Department-----	1
Care and use of animals and equipment; care of transportation; individuals or units assigned mechanical transport will be instructed in the care of animals, equipment, and transportation until motors are issued, when this time will be used for instruction in care, operation, and driving-----	5
Total-----	30
For medical and dental officers (in addition to the time allotted above)—	
Customs of the service-----	1
Official correspondence-----	1
Daily reports and returns-----	1
Total-----	3
For noncommissioned officers—	
Official correspondence-----	1
Daily reports and returns-----	2
Total-----	3

Second week:

For all sanitary troops—	
School of the squad and detachment or company-----	5
Diseases—classification and causes-----	1
Diseases acquired by contact—prevention—venereal prophylaxis-----	1
Food and fly-borne diseases—prevention-----	1
Mosquito-borne diseases—prevention-----	1
Louse-borne diseases—prevention—laundries—delousing-----	1
The Articles of War and courts-martial-----	2
Sanitary troops of the battalion, regiment, division, corps, army-----	1
Materia medica and pharmacy-----	5
Anatomy and physiology-----	5
The Medical Department equipment of the battalion and regiment; camp infirmary-----	2
Care and use of animals and equipment—care of transportation as in first week-----	5
Total-----	30
For medical and dental officers (in addition to the time allotted above)—	
Monthly reports and returns-----	2
Property accountability and responsibility-----	1
Total-----	3
For noncommissioned officers—	
Same as above-----	3

Third week:

	Hours
For all sanitary troops—	
School of the squad, detachment, or company; manual of the litter.....	5
Flea, bug, and tick borne diseases—prevention.....	1
Diseases due to exposure, trauma poisons—prevention.....	1
Excess and deficiency diseases.....	1
Sanitary service of the camp and billet.....	2
Materia medica and pharmacy.....	5
Anatomy and physiology.....	5
The ambulance company—equipment and functions.....	2
The field hospital company, the mobile surgical unit, the mobile hospital, the mobile laboratory, the medical supply unit—equipment—care of transportation as in first week.....	5
Total.....	30
For medical and dental officers (in addition to the time allotted above)—	
Bimonthly, quarterly, and annual reports and returns.....	3
For noncommissioned officers—	
Same as above for officers.....	3

Fourth week:

For all sanitary troops—	
School of the detachment and company; the loaded litter.....	5
Sanitary service of the march in campaign.....	2
Sanitary service in combat.....	2
Shelter and evacuation of casualties.....	1
Pitching shelter tents, hospital ward, and pyramidal tents.....	5
Materia medica and pharmacy.....	5
Anatomy and physiology.....	5
Care and use of animals and equipment; care of transportation (as in first week).....	5
Total.....	30
For medical and dental officers (in addition to the time allotted above)—	
Occasional reports and returns.....	3
For noncommissioned officers—	
Same as above for officers.....	3

SECOND MONTH

First week:

For all sanitary troops—	
School of the detachment and company; removing wounded without litters...	3
First aid.....	3
Gas defense.....	2
Effects of artillery and infantry fire.....	1
A march of $2\frac{1}{2}$ miles with halt and establishment of battalion and regimental aid station or dressing station under an assumed situation, individual cooking, and return to camp.....	6
Nursing.....	4
Riding, driving, or ambulance drill for ambulance companies.....	5
A march of $7\frac{1}{2}$ miles under an assumed situation appropriate for the sanitary unit or detachment.....	6
Total.....	30
For medical and dental officers (in addition to the time allotted above)—	
Occasional reports and returns.....	3

First week—Continued.

For noncommissioned officers—

Same as above for officers	Hours 3
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Terrain exercises: Regimental and battalion surgeons will participate in all regimental and brigade terrain exercises. The division surgeons, commanding officer sanitary train, director ambulance section, and director field hospital section, will participate in all division terrain exercises.

Second week:

For all sanitary troops—

School of the detachment or company; the ambulance	3
First aid	3
Construction of fire shelter	1
Gas defense	2
A march of 3 miles as required in first week, second month	6
Nursing	4
Riding, driving; ambulance drill for ambulance companies	5
A march of 7½ miles under an assumed situation appropriate for the unit or detachment	6
Total	<u>30</u>

For medical officers only—

Terrain exercises (see note first week, second month).

Third and fourth weeks:

For all sanitary troops—

School of the detachment and company; the loaded litter; gas mask worn 15 minutes in each drill	3
Field training: The solution of problems of the sanitary service, either independently or in participation with organizations to which attached, under assumed situations appropriate to the unit. Solution to cover recommendations as to sanitary procedures, management of the sanitary service, selection of sites for unit stations, selection of routes of approach and sanitary evacuation and preparation of casualty lists, with patients represented by tagged individuals (problems for divisional units to be prepared by division surgeon—3 problems, 1 of which shall include a 10-mile march)	18
Nursing	5
Map reading and sketching; location by coordinates	4
Total	<u>30</u>

For officers only (in addition to time allotted for other instructions)—

Terrain exercises (see note first week, second month).

THIRD MONTH

First week:

For all sanitary troops—

School of the detachment or company; methods of removing patients without litter; masks worn 15 minutes at each drill	2
Field training (same as in program third and fourth weeks, second month)	18
Construction of splinter proofs and bombproofs	6
Application of the Thomas splint	4
Total	<u>30</u>

For medical officers only—

Terrain exercises (see note first week, second month).

Second and remaining weeks:

For all sanitary troops—

	Hours
School of the detachment or company	2
Field training (same as in program third and fourth weeks, second month; one march, halt over night, 12 hours; problem 6 hours)	18
Construction of splinter proofs and bombproofs	6
Application of the Thomas splint	4
Total	30

For officers only—

Terrain exercises (see note first week, second month).

FOURTH MONTH

First and second weeks:

For all sanitary troops—

School of the detachment or company	2
Field training (same as in program third and fourth weeks, second month)	24
Application of the Thomas splint	2
Demonstration of sanitary devices for use in the European theater of war	2
Total	30

For medical and dental officers only (in addition to time allotted above)—

Terrain exercises (see note first week, second month).

Instruction in reports, returns, and records and regulations of the American Expeditionary Forces	3
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For noncommissioned officers only—

Instruction in reports, returns, records, and regulations of the American Expeditionary Forces	3
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Third and fourth weeks:

For all sanitary troops—

School of the detachment and company	2
Field training (same as in program third and fourth weeks, second month)	24
Application of the Thomas splint	2
First aid treatment of gassed cases	2
Total	30

For medical officers only (in addition to time allotted for other instruction)—

Military medicine (psychology, psychiatry, malingering, special diseases, including gas poisoning and treatment)	3
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Military surgery (sepsis and treatment; infections by anaerobes—treatment; shock; special methods of treatment, including prophylaxis, and treatment of trench foot	3
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For noncommissioned officers only—

Same as preceding two weeks	3
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Special training: In addition to the combat and technical training or organizations given in this program additional training will be given as follows—

For all troops (daily except Sunday), physical training (minimum), 20 minutes.

For all buglers, manual of the bugle, 30 minutes.

For mess sergeants and cooks (including one alternate mess sergeant and two alternate cooks), course to be given at a convenient time during the earlier weeks of the training period by a visiting field party of the Medical Department food and nutrition section which will carry with it a rolling kitchen and equipment for establishing a center of instruction within the divisional training area. Subjects of course: Food principles and values; selecting and balancing the diet; storage and preservation of foods; arrangement of the kitchen; care and cleaning of kitchen and equipment; cooking and service; use of the rolling kitchen and equipment; improvisation of cooking devices; food conservation and salvage of kitchen wastes; kitchen sanitation.

Instruction for drivers of motor transportation (center of instruction to be established within the division area by the commander of trains). Subjects of instruction: Cleaning and oiling; starting and stopping; shifting gears; making road repairs; driving; moving in train; parking; traffic regulations; towing; troubles.

The application of the scheme given above to the training of the Medical Department with divisions can be shown by the following extract from program of training for 86th Division:

SANITARY TROOPS

First week:

	Hours
Close order drill; the loaded litter and first aid.....	3
Defense against gas.....	2
Personal hygiene; venereal prophylaxis, care of feet, shoes, trench feet.....	1
General hygiene; march, camp, trench, combat, disposal of the dead.....	3
Water and food; supply examination, treatment, preservation, in trench and field.....	1
Clothing; laundries, bathing, supplies, methods of cleaning, devices, delousing, insecticides.....	2
Disposal of wastes and demonstration of sanitary devices—human, animal, kitchen and camp garbage, in field and trench warfare.....	2
Organization of the American Expeditionary Force.....	1
Disposition of combatant and auxiliary troops; march, attack, defense, retirement, trench warfare.....	3
Artillery and infantry weapon; effects.....	1
Intrenching (instructions for the defensive combat of small units).....	5
Attached sanitary troops—construction of shelter for battalion and regimental aid stations in connection with work of rifle companies and battalions, construction of shelter for advanced groups of litter bearers, dressing stations, etc. March (a day's march of not less than 10 miles); attached sanitary troops will march and function as sanitary troops under the assumed situations of the organization to which attached (see general program).....	6
Total.....	30

Second week:

Close order drill; handling patients without litters.....	3
First aid and Thomas splint.....	3
Defense against gas.....	2
Shelter—selection, improvization, construction of huts—barracks, billets, and their sanitary inspection.....	2
Field orders.....	1
Field sketching and map reading.....	6
Intrenching.....	4
Organization of the sanitary service—battalion and regimental detachments, camp infirmaries, camp hospitals, the sanitary train, the sanitary column, and other establishments and their units of the line communications; their personnel, functions, and equipment for open and trench warfare.....	3
March (a practice march as required in program for first week).....	6
Total.....	30

Division terrain exercises.—The division surgeon, commanding officer, sanitary train, and directors of ambulance companies and field hospital sections will participate in all division terrain exercises.

Third week:

Close order drill and the ambulance.....	3
First aid and use and application of the Thomas splint.....	8
Defenses against gas.....	2
Casualties; classification and disposal.....	1

Third week—Continued.

Field training—

For battalion and regimental detachments—

- (a) Practice and training in methods and duties pertaining to the sanitary service of units to which attached..... 10
- (b) Open warfare: Sanitary service of the march, camp, attack, defense, retirement, advance, and rear guard. Solution and execution of problems independently, and combined with the organizations to which attached. Solutions to cover recommendations as to sanitary procedures and sanitary orders; selection of sites for unit stations; selection of routes of approach and sanitary evacuation; actual establishment of casualty lists, with patients represented by tagged individuals.
- (c) Trench warfare: Solution of problems given above under open warfare together with actual construction of shelter and adaptation of equipment and procedures to changed conditions due to types of action.

For divisional units—Field training as given in (b) and (c) under conditions assumed, appropriate for the unit..... 10

A. B. C.: Battalion, regimental surgeons and all sanitary units will participate in terrain exercises with the units to which attached in connection with the general program.

March: A practice march as required in program for first week..... 6

Division terrain exercises: The division surgeon, commanding officer, sanitary train, and directors of ambulance companies and field hospital sections will participate in all division exercises.

Fourth week:

Close order drill, the loaded litter, the ambulance..... 6

Defense against gas..... 2

First aid and use and application of the Thomas splint..... 6

Field training—

For battalion and regimental detachments—

- (a) Practice and training in methods and duties pertaining to the sanitary service of the units to which attached as given for third week..... 10

For divisional units—

As given for third week..... 10

March (as required in program for first week)..... 6

NOTE.—The instruction will consist of conferences, practical exercises, demonstrations, and problems for the purpose of training the personnel of the sanitary service in its duties, both in open and trench warfare, and must be thorough and practical. Instruction in sanitation, medicine, and surgery will be limited to preparations for the mastery of the problems presented by the service conditions which may be encountered by the American Expeditionary Forces in open and trench warfare.

DURING THE TRAINING PERIOD

For medical officers only, in addition to time allotted for other instruction:

1. Military surgery—sepsis, antisepsis, infection by anaerobes, shock, special methods of treatment including prophylaxis and treatment of trench feet..... 10
2. Military medicine—psychology, psychiatry, malingering, special diseases, including gas poisoning and treatment..... 10

Division terrain exercises: The division surgeon, commanding officer, sanitary train, and directors of ambulance companies and field hospital sections will participate in all division terrain exercises.

MEDICAL DEPARTMENT SCHOOLS

Medical Department schools in the American Expeditionary Forces comprised the Army Sanitary School, Langres (Medical Corps School; Dental Corps School); corps schools; special schools (gas school, Gondrecourt; First Replacement Depot Sanitary School, St. Aignan-Noyers).⁴ The Army Sanitary School, Langres, is the subject of a separate chapter.

CORPS SCHOOLS

The first of the corps schools to be established was the First Corps school, which began operations at Gondrecourt, France, as the First Corps center of instruction, and was intended to cover the 1st, 2d, 26th, and 42d Divisions training in the vicinity. It contained a field service school for medical officers established under the name of First Corps Sanitary School, October 15, 1917.⁴ The course was planned to cover five weeks; however, owing to an epidemic of scarlet fever at Base Hospital No. 18, where the school was established, the course was abandoned after three weeks.⁴ The director was relieved from duty November 3, 1917, and ordered to the Army schools at Langres for duty as commandant of the Army Sanitary School to be opened thereat.⁴

After the abandonment of the first course, the First Corps Sanitary School began another course in January, 1918, with only a few medical officers in attendance. Because of the scarcity of shelter, material, and personnel in the American Expeditionary Forces, neither equipment nor special shelter could be secured, consequently the school was unsatisfactory as to results and no further courses were held.

In February, 1918, a sanitary school was established at the Second Corps school organized at Chatillon sur Seine, where better facilities for housing and instruction existed. However, because of the shortage of medical officers in the American Expeditionary Forces this sanitary school completed only one course of four weeks. As the shortage of medical officers was not remedied, it was found that the Army Sanitary School at Langres could accommodate all the medical officers coming with advance detachments and the few others that could be spared from combat divisions and the Services of Supply, and no other corps sanitary schools were established. This was the only Medical Department field service school operated after February, 1918.⁴

The following program was prepared for tentative use in connection with Medical Department training in corps sanitary schools:⁴

TENTATIVE PLAN FOR CORPS SANITARY SCHOOL

There will be five principal subjects treated in the corps school, which will be a five weeks' course. Two weeks of this should be devoted to war surgery and military medicine. The other three weeks should be spent at the school, where, in contact with divisional troops, attendants will be taught the other three subjects:

WAR SURGERY

1. General principles of surgery.
2. Emergency surgery at the front and general treatment of wounded
3. Special surgery:
 - (a) Wounds of face and neck.
 - (b) Wounds of chest and abdomen.
 - (c) Wounds of head, brain, and nervous system.
 - (d) Wounds of blood vessels.
 - (e) Fractures and joint injuries.
4. Roentgenology.
5. Venereal diseases and genitourinary surgery.

MILITARY MEDICINE

1. Influence of war in producing diseases not infectious.
2. The psychology and psychiatry of war, malingering.
3. The remedial agents supplied by the Medical Department.
4. The field laboratory.
5. Nursing.
6. Special pathology, symptoms and treatment of gassed cases.
7. The communicable diseases.
8. Preventive medicine and carriers of pathogenic organisms.
9. The importance of mild respiratory infections, their nature, probable etiology and means of prophylaxis; pneumonia.
10. Infections in general, and their treatment.
11. Transfusions.
12. Diseases of the skin.

MILITARY HYGIENE

1. Morbidity and mortality in the military service.
2. Insecticides.
3. Physical culture.
4. The march; the camp.
5. Personal hygiene.
6. Water.
7. Food, dietetics, and cooking.
8. Clothing and equipment.
9. Shelter and the construction of military hospitals.
10. Heating and lighting.
11. Disposal of wastes and latrines.
12. Disinfection, disinfectants, and quarantine.
13. Hygiene of the battle field.
14. Sanitary appliances.

MILITARY MEDICAL ADMINISTRATION

1. Army Regulations.
2. The Field Service Regulations; organization of the land forces of the United States; Tables of Organization.
3. Manual for the Medical Department.

SANITARY TACTICS

1. Field orders.
2. Map reading.
3. Ballistics.
4. Casualties.
5. Means and mode of evacuation.

6. Summary of personnel, equipment, and supplies of Medical Department organizations from front to rear.
7. Collection and evacuation of sick and wounded.
8. The ambulance company:
 - (a) Composition.
 - (b) Equipment.
 - (c) Administration.
 - (d) Duties in camp, on the march, and in battle.
9. The field hospital:
 - (a) Composition.
 - (b) Equipment.
 - (c) Administration.
 - (d) Duties in camp, on the march, and in battle.
10. The dead, and the rôle of the medical officer.
11. Hippology.
12. Automobiles, their engines, construction, repairs, and spare parts.
13. Sanitary engineering—dugouts, trenches, bombproofs, and construction of their shelter and of sanitary appliances.
14. Gas defense.

SUMMARY

Didactic course:	Hours
1. War surgery.....	40
2. Military medicine.....	25
3. Military hygiene.....	25
4. Sanitary tactics.....	50
5. Medical military administration.....	25
6. Gas defense and chemistry.....	25
Total.....	190
<hr/>	
Practical course:	
Field exercises.....	36
Visit to the front.....	24
Visit to base hospital.....	8
Clinics.....	8
Hygiene.....	10
Hippology.....	3
Automobiles.....	4
Sanitary engineering.....	5
Total.....	98

Total, 288 hours, course of 6 weeks, working 8 hours a day for 6 days a week.

Upon this tentative program, the following course of instruction was formulated and given at the First Corps Sanitary School.⁴

COURSE OF INSTRUCTION FOR THE SANITARY SCHOOL, FIRST CORPS CENTER OF INSTRUCTION
FOR THE PERIOD OCTOBER 15 TO NOVEMBER 3, 1917

Monday, Oct. 15, 1917:

- | | |
|------------------------|---|
| 6.45 a. m..... | Medico-military administration. |
| 8.45 a. m..... | Sketch of Medical Department organization in war. |
| 9.45 a. m..... | The sanitary officer. |
| 10.45 a. m..... | The collection and evacuation of wounded. |
| 1.30 p. m..... | The regimental sanitary organization in general and its equipment. |
| 2.30 to 4.30 p. m..... | Examination of equipment and discussion of its mode of application. |

Tuesday, Oct. 16, 1917:

8.45 a. m.-----	The battalion surgeon in trench warfare.
9.45 to 11.45 a. m.-----	Sanitary inspection.
1.30 p. m.-----	The regimental surgeon in trench warfare.
2.30 p. m.-----	Personal hygiene.
3.30 p. m.-----	Food.

Wednesday, Oct. 17, 1917:

7.45 a. m.-----	Medico-military administration.
8.45 a. m.-----	Problems, battalion sector, trench warfare.
9.45 a. m.-----	The ambulance company.
10.45 a. m.-----	The duties of an ambulance company on the march, in battle, and in camp.
1.30 p. m.-----	Water.
2.30 p. m.-----	The standard United States Army litter; the wheeled litter; the carrying of wounded by hand and by the trench litter.
3.30 p. m.-----	Comparison of French, English, and German regimental organizations with our own.

Thursday, Oct. 18, 1917:

7.45 a. m.-----	Medico-military administration.
8.45 a. m.-----	The administration of an ambulance company.
9.45 a. m.-----	The application of our ambulance company to present methods of warfare.
10.45 a. m.-----	Clothing and equipment.
1.30 p. m.-----	Dugouts.
2.30 to 4.30 p. m.-----	Examination of trenches and dugouts, training section.

Friday, Oct. 19, 1917:

8.45 a. m.-----	The equipment of our ambulance companies.
9.45 to 11 a. m.-----	Demonstration of equipment of ambulance company.
2.30 p. m.-----	Garbage and waste.
3.30 p. m.-----	The motorized and animal-drawn ambulance company compared, and the special application.

Saturday, Oct. 20, 1917:

7.45 a. m.-----	Medico-military administration.
8.45 a. m.-----	The dressing station.
9.45 a. m.-----	The litter bearer group.
10.45 a. m.-----	Shelter, heating, and ventilation.
1.30 p. m.-----	Military administration: Troops, batteries, and companies; interior economy of companies; messing and cooking; company and mess funds; roster; daily service.
2.30 to 4.30 p. m.-----	Problem, sanitary tactics, trench warfare, battle of the Somme.

Monday, Oct. 22, 1917:

7.45 a. m. to 4.30 p. m.---	Practical gas instruction.
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Tuesday, Oct. 23, 1917:

7.45 a. m. to 4.30 p. m.---	Practical gas instruction.
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Wednesday, Oct. 24, 1917:

7.45 a. m. to 4.30 p. m.---	Practical gas instruction.
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Thursday, Oct. 25, 1917:

7.45 a. m.-----	Medico-military administration.
8.45 a. m.-----	The administration of a field hospital.
9.45 a. m.-----	The duties of a field hospital in camp, on the march, and in battle.
10.45 a. m.-----	The application of our field hospital to present methods of warfare.

Thursday, Oct. 25, 1917—Continued.

- 1.30 p. m.----- Consideration in equipment and supplies of a field hospital.
- 2.30 p. m.----- The prevention of typhoid fever, paratyphoid, cerebrospinal meningitis, and diphtheria.
- 3.30 p. m.----- Excreta.

Friday, Oct. 26, 1917:

- 8.30 a. m. to 4.30 p. m.---- Field exercises. French problem on maneuver ground "La-fayette" with field hospital, ambulance company, and regimental unit in liaison.

Saturday, Oct. 27, 1917:

- 7.45 a. m.----- Medico-military administration.
- 8.45 a. m.----- Military administration: The chief of staff; intelligence officer; the adjutant; military correspondence; orders; muster rolls, returns of troops; battle reports, casualties; records; personnel and efficiency reports.
- 9.45 a. m.----- Occupation of buildings extemporized as shelter for a field hospital.
- 10.45 a. m.----- Prevention of venereal disease.
- 1.30 p. m.----- Military administration: Arrest, confinement, and courts; the laws of war.
- 2.30 p. m.----- The specialization of field hospitals in trench warfare—French, English, and German methods.
- 3.30 p. m.----- Disinfection, disinfectants, and quarantine.

Monday, Oct. 29, 1917:

- 7.45 a. m.----- Medico-military administration.
- 8.45 a. m.----- The evacuation hospital and its transport.
- 9.45 a. m.----- Recent advances in prevention of infectious diseases; insecticides and practical methods of delousing.
- 10.45 a. m.----- The field hospital and duties of directors of field hospitals and ambulance companies.
- 1.30 p. m.----- Hippology.
- 2.30 to 4.30 p. m.----- The saddles and bridles of horses and demonstration of the pack saddle.

Tuesday, Oct. 30, 1917:

- 7.45 a. m.----- Medico-military administration.
- 8.45 a. m.----- New sanitary appliances.
- 9.45 a. m.----- The dead and the rôle of the medical officer.
- 10.45 a. m.----- Education and training of Medical Department personnel.
- 1.30 p. m.----- Marches and camps.
- 2.30 to 4.30 p. m.----- Automobiles, their engines, construction, repairs and spare parts; demonstration.

Wednesday, Oct. 31, 1917:

- 7.45 a. m.----- Medico-military administration.
- 8.45 a. m.----- New ordnance in its relation to medical units.
- 9.45 a. m.----- Morbidity and mortality in the military service.
- 10.45 a. m.----- Military administration: Duties of medical officers; the register and report of sick and wounded.
- 1.30 to 4.30 p. m.----- Review.

Thursday, Nov. 1, 1917:

- 7.45 a. m.----- Medico-military administration.
- 8.45 a. m.----- Field orders.
- 9.45 a. m.----- Maps.
- 10.45 a. m.----- Military administration: The sanitary service in war—organization, objects, and duties; the American Red Cross.
- 1.30 p. m.----- Field Service Regulations: Security; marches; combat.
- 2.30 to 4.30 p. m.----- Sanitary inspection, demonstration of bath, and delousing apparatus.

Friday, Nov. 2, 1917:

8.30 a. m. to 4.30 p. m. --- Maneuvers—ground "Lafayette."

Saturday, Nov. 3, 1917:

7.45 a. m. --- Medico-military administration.

8.45 a. m. --- Military administration: Medical Department correspondence, reports, records, and returns in time of war.

9.45 a. m. --- Battle-field casualties.

10.45 a. m. --- Medical supplies in time of war.

1.30 to 3.30 p. m. --- Field Service Regulations: Tables of Organization; administration of zone of interior, of theater of operations, zone of advance, and line of communication; communication; transportation.

SPECIAL SCHOOLS

GAS SCHOOL, FIRST CORPS CENTER OF INSTRUCTION

As noted above, under the program of instruction for the sanitary school, First Corps center of instruction, practical instruction was given in gas warfare. The gas school for this purpose was a part of the center and was under the direction of a medical officer who started instruction on the date the center of instruction was established.³ This gas school was the only one of the gas schools in which the Medical Department participated.⁵

SANITARY SCHOOL, FIRST DEPOT DIVISION, ST. AIGNAN-NOYERS

To meet the requirements of the general training program of the American Expeditionary Forces, which called for training newly arrived members of the American Expeditionary Forces in a depot division, a training school was established in the 1st Depot Division, St. Aignan-Noyers, on March 10, 1918.⁶

Sanitary troops passing through the division to the front, and those on duty in the division, were given instruction in first aid, drill, etc.

Camp Hospital No. 26 maintained a large dental clinic, when in the late spring of 1918 a course of instruction was instituted for enlisted dental assistants.⁶ From here, enlisted dental assistants were distributed throughout the American Expeditionary Forces.⁶

PROFESSIONAL INSTRUCTION

Professional instruction, being entirely intradepartmental, was not considered under the head of training; therefore it was not covered by the activities of G-5, general headquarters, A. E. F., but was conducted in the Services of Supply by the professional services.⁴

Formal courses of professional instruction were conducted at the central Medical Department laboratory, Dijon,⁴ and at the School of Pharmacy of the University of Paris.⁷

CENTRAL MEDICAL DEPARTMENT LABORATORY, DIJON, FRANCE

One of the important activities of the central Medical Department laboratory,^a which was established January 1, 1918,⁸ was concerned with the instruction of medical personnel in certain phases of laboratory technique in

* For an account of the organization and work of the central Medical Department laboratory, other than its instructional activities, see Vol. II, Chap. X, of this history.

order that more efficient service might be rendered by officers so instructed in whatever hospital or other organization they might be detailed to serve. To this end special courses were organized for instruction in (1) the bacteriology of epidemic diseases; (2) the bacteriology of war wounds; (3) shock and resuscitation; (4) water supply work; (5) serology (Wassermann reaction).

BACTERIOLOGY OF EPIDEMIC DISEASES

One of the first subjects to engage the attention of the director of the division of laboratories and infectious diseases was the collection of definite information concerning the transmissible diseases prevailing in the allied armies on the Western Front and likewise in the civilian population in France.⁸ It was learned that we might expect typhoid fever, paratyphoid fever, bacillary dysentery, epidemic cerebrospinal meningitis, the pneumonias, diphtheria, venereal diseases, and other diseases of bacterial origin. The specific etiology and methods of transmission of trench fever were unknown at that time, and it was not anticipated that protozoal infection would give us any particular concern. As all the diseases mentioned above except trench fever, were quite generally distributed throughout the United States, it could be safely inferred that a considerable percentage of the personnel would be familiar with their bacteriology and, furthermore, special courses of instruction covering the bacteriology of these diseases was being given at the Army medical schools at Washington, D. C., Fort Leavenworth, Kans., and Yale University, New Haven, Conn., and at Rockefeller Institute, New York City.⁸ It was presumed, therefore, that the laboratory personnel in general would be fairly well equipped for the bacteriological work connected with infectious diseases. However, while there was no necessity for general routine training in this respect, a careful review of the special qualifications of a considerable number of officers who had been listed as laboratory specialists, indicated that some of them might well take such a course as the one under consideration, with profit to themselves and to the service.⁸ Particular attention in this respect was given to the personnel assigned to divisional laboratories and, when military requirements permitted, to the personnel of base hospitals, practically all of which were provided with men well qualified for the work.⁸

BACTERIOLOGY OF WAR WOUNDS

The organization of a special course in the bacteriology of war wounds was instituted by reason of the fact that soon after our entry into the war the French surgical service had been able to demonstrate that débridement of war wounds offered a very distinct advance in operative procedure, permitting early closure of wounds.⁹ Many of their surgeons controlled their closures by bacteriological examinations. In January, 1918, the surgical advisors of the chief surgeon's office requested that the laboratory service be prepared to do this work for them.⁹ This phase of laboratory activities was developed at the central Medical Department laboratory, and the special course of instruction given consisted of a two-weeks' period of study of aerobes, anaerobes, and streptococci.⁹

This instruction was begun in the central Medical Department laboratory in June, 1918.⁹ Previous to that time various groups of men had been sent to

the Pasteur Institute, Paris, to the center for surgical research of the French Medical Department, at Epernay, to Belfort, and to Dunkirk. The information which formed the basis of the instruction given at the central Medical Department laboratory was obtained from visits, by the director of the course, and other medical officers, to the above-named places, and to La Panne, Boulogne, and Chalons, from published books and reports on the subject, and from reports of the courses of instruction given at the places visited, and from current periodical literature.⁹

The first course in wound bacteriology was a six-day series of lectures and practical work.⁹ The course was lengthened later to two weeks. Nine courses were given, with a total attendance of 138.⁹

It was planned to have in every evacuation and independent base hospital at least one officer, and in each hospital center one or more conversant with this type of work, and when the armistice went into effect this had been accomplished.⁹

The student officers were shown different types of wounds.⁹ They were taught how to obtain specimens from the wounds, and were shown retarded primary suture and secondary sutures. When evacuation was fairly rapid, wounded soldiers arrived at Base Hospital No. 17 (Dijon), within two or three days after injury, sometimes with field dressings unchanged. The student officers were then given an opportunity to see excision and débridement of wounds and to study the bacteriology of the débrided margins of wounds. When amputation was performed for wound infection or gaseous gangrene the amputated limb was taken to the laboratory, dissected before the class, and its bacteriology studied. The same was done with fatal cases of gaseous gangrene, which were autopsied before the class and the bacteriology of wound and the heart blood studied. Wound exudates obtained in this way were taken to the laboratory. Each student officer was required to determine the bacterial count according to the Carrel method, and to isolate the bacteria present and to report on the cytology of the wound exudate. He was further required to give an opinion as to whether his results permitted wound closure or contra-indicated it.

The officers reported only on wounds that they saw clinically and had personally examined later at the laboratory.⁹ Methods for rapid isolation and identification of the organisms whose presence were particularly dangerous in wounds were gone over in detail and applied to the diagnosis of these wound exudates. The classes were all furnished pure cultures of the 20 organisms studied and were required to study their morphology in the hanging drop and smears stained with Gram and special stains so as to demonstrate the presence of capsules in capsulated organisms, flagella, and spores wherever these were present. Each organism was studied with regard to its cultural characteristics in agar, Veillon agar, broth, milk, liver peptone, water, potato, glucose, lactose, maltose, saccharose, mannite, and glycerine. The cultures were studied at 24-hour intervals for 3 days, and the growth was examined in hanging drop and stained smears. Various methods of anaerobic culture were described in detail and the technical difficulties of each method explained. Owing to the lack of the complicated anaerobic apparatus suggested by various workers, and their impractica-

bility under war conditions, it was decided to concentrate upon the technique suggested by Veillon and developed by Weinberg, and to use Veillon agar for solid media and liver peptone water medium for the isolation of all anaerobes in fluid cultures. Other fluid media were boiled previous to use, cooled and calcium sulphide added after inoculation and then covered with sterile paraffin oil.

In this way they were able to isolate nearly all of the organisms described as occurring in wounds and to identify them by means of the culture media and apparatus available under actual war conditions. The serologic characteristics of these organisms were studied, the officers being required to identify various anaerobes by means of agglutinating serum. Neutralization of toxin and of toxic cultures by specific antitoxins were demonstrated. Guinea pigs and white mice were inoculated with lethal quantities of cultures of the various anaerobes and the specific lesions demonstrated. The officers were required to study the bacteriology of the muscle exudate and heart blood of these animals after death. The last three days of the course were devoted to the identification of unknown mixed cultures. These unknown mixtures contained two aerobes and three anaerobes, and the officers were rated, first, according to their technique; second, according to their theoretical knowledge of the subject, as determined by oral examinations held at the end of each week's course; and, finally, upon their identification of the unknown.

Other factors pertaining to the study of wounds were touched on in various lectures. A lecture on ballistics and also on the chemistry of certain antiseptics used in wound treatment were given. Pathological physiology of wounds and the pathological histology of wounds were similarly included so that the student officers could have a general knowledge of the subject plus the special training in the natural history of the bacteria found in wounds. The general principles underlying the preparation and effects of toxin and antitoxin were reviewed, and their application to the treatment of wound infection was described. Wound treatment was gone over very briefly and its relationship to wound bacteriology pointed out. In addition, a certain amount of instruction was given in the preparation of bulb pipettes, sealing of tubes and other manipulations of glass were essential in anaerobic bacteriology.

The course of lectures on wound bacteriology given to the classes during each session, is outlined below:⁹

OUTLINE OF LECTURES ON WOUND BACTERIOLOGY

LECTURE I

a. Program of course.

b. Introduction. General discussion:

(a) Aseptic wound and war wound.

(b) Evolution of subject; wounds of the Balkan wars; wounds of the first year of present war; Carrel's experiment on transplantation; vaccine treatment; introduction of use of Labarraques solution; introduction of Carrel-Dakin method of treatment.

(c) Wound production; factors that enter into the production of wounds.

(1) Projectiles—bullets, shell casing, hand grenade, secondary projectiles (wood, stone, hard tissues—bone and teeth).

(2) Tissues destroyed—soft parts, bony tissues, viscera, serous cavities, vascular tissue.

b. Introduction. General discussion—Continued.

- (d) Structural details and histology of wounds—character on cross section (macroscopic, microscopic).
- (e) Wound infection.
 - (1) Source of infection—projectile, clothing, skin.
 - (2) Type of infection—wound contamination, early, selective; secondary, adaptation, extension; symbiotic; latent.
 - (3) Physical factors favoring bacterial development.
- (f) Bacteria found in war wounds—pathogenic, aerobic, anaerobic; saprophytic; bacterial associations.

LECTURE II

a. Method of obtaining specimens:

- (1) Direct smear.
- (2) Cellophane method.
- (3) Pipette.
- (4) Tampon.
- (5) Excised tissue muscle; granulations; skin; bone.
- (6) Foreign bodies: Projectiles; clothing débris; bone fragments.

b. Where obtained:

- (a) Wound—different parts.
- (b) Surrounding tissue; débridement; vesicle: muscle.
- (c) Blood culture:
 - (1) Vein.
 - (2) Post-mortem—heart, peripheral veins.

c. Technical precautions.

d. Bacterioscopy:

- (a) Direct smear.
- (b) Hanging drop.
- (c) Spread.
- (d) Scaled pipette.
- (e) Staining.

e. Diagnosis of stained smear:

- (a) Morphology of bacteria.
- (b) Staining reactions.

LECTURE III

(Second day—a. m.)

Ballistics:

- (1) Muzzle velocity.
- (2) Shell velocity.
- (3) Disseminated energy.
- (4) Composition of projectiles.

LECTURE IV

a. Pathologic physiology and biochemistry of wounds:

- (1) Aseptic; operative, and war.
 - (a) Necrobiosis.
 - (b) Autolysis.
 - (c) Leucocytic proteolysis.
 - (d) Blood clot.
 - (e) Foreign bodies.
 - (f) Bacterial products—toxins and ptomaines.

b. General significance:

- (1) To wound.
- (2) To life.
- (3) To utility—neuritis, atrophy, painful scars.

LECTURE V

- a. Bacterial counts:
 - (1) Carrel technique—preferable.
 - (2) Modified technique—personal equation.
- b. Cytological examination:
 - (1) Leucocyte curve.
 - (2) Leucocytic index.
 - (3) Mononucleosis.
 - (4) Eosinophilia—significance, technique.
- c. Significance of bacterial enumeration:
 - (1) In retarded primary suture.
 - (2) In secondary suture.
 - (3) Pus—retention and secondary infection.
 - (4) Chemical disinfection.
 - (5) Autovaccination; experience at La Panne.
- d. Comparison of bacterial charts.
- e. Colony enumeration:
 - (1) Slant agar.
 - (2) Veillon tube.
 - (3) Vignal tube.
 - (4) Elser tube.

LECTURE VI

General methods of bacterial isolation and identification:

- (1) Isolation.
 - (a) Aerobic.
 - (b) Anaerobic.
 - (c) Filterable microorganisms.
- (2) Identification.
 - (a) Morphology in solid media.
 - (b) Cultural characteristics.
 - (c) Biochemical properties.
 - (1) Carbohydrate fermentations.
 - (2) Protein fermentations.
 - (3) Peptolytic properties.
 - (d) Serologic reactions—agglutinations, neutralization experiments, complement fixations.
 - (e) Pathogenicity tests—total cultures, filtered or centrifuged toxin.
 - (f) Lesions produced.

LECTURE VII

Aerobic bacteria found in wounds belonging to coccus group:

- (1) Streptococcus.
 - (a) Hemolyticus.
 - (b) Viridans.
 - (c) Nonhemolyticus.
- (2) *Staphylococcus albus*, *aureus* (hemolyticus, nonhemolyticus) *citreus*, *micrococcus candidus*.
- (3) Pneumococcus.
- (4) Enterococcus.
- (5) *Diplococcus Griseus nonliquefaciens*.

LECTURE VIII

Aerobic bacteria found in wounds belonging to bacillary group:

- (1) Organisms of the colon group.
 - (a) *Bacillus coli communis*.
 - (b) *Bacillus Friedlander*.
- (2) Proteolytic group.
 - (a) *Bacillus proteus vulgaris*.
 - (b) *Bacillus pyocyaneus*.

LECTURE IX

Aerobic bacteria found in wounds belonging to bacillary group:

- (1) Spore bearing aerobe group.
 - (a) *B. subtilis*.
 - (b) *B. myscoides*.
 - (c) *B. mesentericus*.
 - (d) *B. anthracoides*.
- (2) Coryne-Bacterium group.
 - (a) *B. cutis communis*.
 - (b) *B. diphtheria*.
- (3) Differential characteristics.
 - (a) Staining reactions.
 - (b) Cultural characteristics.

LECTURE X

a. Preparation of general and special media:

- (1) Egg albumin glucose peptone media (Weissenbach).
- (2) Blood media.
- (3) Liver peptone media (Jablons and Pease).
- (4) Egg albumin media.
- (5) Meat media for spores.
- (6) Veillon media.
- (7) Sterilization.

b. Conservation of strains.

LECTURE XI

Methods for anaerobic bacterial isolation and identification:

- (1) Anaerobiosis.
 - (a) Exclusion of air.
 - (b) Displacement of air.
 - (c) Vacuum formation.
 - (d) Absorption of air.
- (2) Apparatus for anaerobic work.
 - (a) Paraffin layer tubes.
 - (b) Wright tube.
 - (c) Buchner tubes.
 - (d) Pinoy tubes.
 - (e) Anaerobic jar (Bullock, Novy).
 - (f) Vacuum apparatus.
 - (g) Hydrogen apparatus.
 - (h) MacIntosh and Fildes apparatus.
 - (i) Anaerobic plates.
 - (j) Vignal tubes.
 - (k) Elser tubes.
 - (l) Fermentation tubes (Dunham and Fleming).

LECTURE XII

a. Anaerobes encountered in wounds:

- (1) Anaerobes of primary importance.

b. *Welchii* (*B. perfringens*).

- (1) History.
- (2) Methods of isolation.
- (3) Methods of identification.
- (4) Morphology.
 - (a) Staining characteristics.
 - (b) Motility.

b. Welchii (B. perfringens)—Continued.

- (5) Cultural characteristics.
- (6) Biochemical properties—saccharolytic, proteolytic, peptolytic.
- (7) Serological characteristics.
- (8) Pathogenicity (total culture and toxins).
- (9) Experimental infection: Symptoms, lesions.

LECTURE XIII

a. Vibrio septique (relationship to B. malignant edema):

- (1) History.
- (2) Methods of isolation.
- (3) Methods of identification.
- (4) Morphology.
 - (a) Staining characteristics.
 - (b) Motility.
- (5) Cultural characteristics.
- (6) Biochemical properties—saccharolytic, proteolytic, peptolytic.
- (7) Serological characteristics.
- (8) Pathogenicity (total culture and toxins).
- (9) Experimental infection: Symptoms, lesions.

LECTURE XIV

a. Bacillus of toxic edema (B. edematiens, B. bellonensis, B. gas edem (Aschoff), Type XIII, British Research Committee):

- (1) History.
- (2) Methods of isolation.
- (3) Methods of identification.
- (4) Morphology.
 - (a) Staining characteristics.
 - (b) Motility.
- (5) Cultural characteristics.
- (6) Biochemical properties—saccharolytic, proteolytic, peptolytic.
- (7) Serological characteristics.
- (8) Pathogenicity (total culture and toxins).
- (9) Experimental infection: Symptoms, lesions.

LECTURE XV

a. Proteolytic anaerobes of secondary importance:

- (a) *B. sporogenes*.
- (b) *B. putrificus*.
- (c) *B. bifermentans*.
- (d) *B. histolyticus*.
 - (1) Morphology.
 - (2) Cultural characteristics.
 - (3) Biochemical properties.
 - (4) Serologic characteristics.
 - (5) Pathogenicity.

LECTURE XVI

Anaerobes of unusual occurrence in wounds:

- (a) *B. fallax*.
- (b) *B. aerogenes*.
- (c) *B. tertius*.
 - (1) Morphology.
 - (2) Cultural characteristics.
 - (3) Biochemical properties.

LECTURE XVII

- a. Anaerobic streptococci—significance.
- b. Occurrence of the above alone and in symbiosis.
- c. Conditions under which they become dangerous.
- d. Suggestions for the practical examination of unknown exudates.

LECTURE XVIII

Serious wound infections:

- (1) Gas gangrene.
 - (a) Bacteriology.
 - (b) Older conceptions.
 - (c) Recent conceptions.
 - (d) Symptomatology.
 - (e) Pathology.
 - (f) Treatment.

LECTURE XIX

a. Toxin production:

- (1) In different media.
 - (a) Bull and Pritchett (*B. Welch*).
 - (b) Nicolle and Frasey (*Vibrion septique*).
 - (c) Weinburg and Sequin (*B. œdematiens*).

b. Antitoxin production:

- (1) Anti-Welch.
- (2) Anti-Vibrion septique.
- (3) Anti-œdematiens.
- (4) Anti-Bellonensis.
- (5) Polyvalent sera.

c. Animal pathogenicity:

- (1) Lesions produced locally.
- (2) Symptoms of intoxication.

d. Agglutination tests:

- (1) Against antibacterial serum.

LECTURE XX

Serious wound infections (continued):

- (1) Streptococcemia.
- (2) Tetanus.
 - (a) Acute.
 - (b) Late.
 - (c) Post-serum.

LECTURE XXI

Wound treatment:

- (1) Surgical disinfection.
 - (a) Primary suture.
 - (b) Retarded primary.
 - (c) Secondary.
- (2) Chemical disinfection.
 - (a) Carrel-Dakin.
 - (b) Eusol.
 - (c) Mestrezat—acid hypochlorite.
 - (d) Dichloramin-T paste.
 - (e) Phenol.
 - (f) Iodine.
 - (g) Formalin.
 - (h) Dyes—methylene blue, flavine, acroflavine, B. I. P. (bismuth-iodoform paste).
 - (i) Wright hypertonic solution.
 - (j) Alkali.

Wound treatment—Continued.

- (3) Biologic therapy.
 - (a) Serotherapy.
 - (1) Curative.
 - (2) Prophylactic.
 - (b) Antistreptococcus.
 - (c) Leclainche and Vallee—polyvalent.
 - (d) Bull—antitoxin.
 - (e) Weinberg—mixed.
 - (f) Sacquepee—antibellonensis.
- (4) Physical therapy.
 - (a) Irrigation.
 - (b) Heliotherapy—Sun, Finsen ray, electric lamp, ultra-violet ray.
 - (c) Hot-air therapy.
 - (d) Cautery.
 - (e) Ionization.
- (5) Physiologic rest.

LECTURE XXII

- a. Preparation and titration of Dakin's solution.
- b. Determination of antiseptic power of different antiseptics:
 - (1) Phenol coefficient.
 - (2) Thread method.
 - (3) Elser diffusion method.

LECTURE XXIII

- a. Collection of statistical information.
- b. Practical suggestions in case of active work.
- c. Practical suggestions in case of lull in activity.

SHOCK AND RESUSCITATION

Classes of instruction in shock and resuscitation were organized as part of the work of the laboratory of surgical research, which was established as one of the activities of the central Medical Department laboratory.¹⁰ The purpose of this instruction was to give special and essential training to "shock teams" serving in the forward areas.¹⁰

One of the first facts brought out in the course of the early research on shock and hemorrhage was that as blood pressure falls a critical level is reached, below which the circulation becomes so greatly retarded that there is an insufficient oxygen supply to the tissues. Evidence for this was gained through an examination of the blood, which showed that as the pressure fell below the critical level there was an accumulation of acid in the blood which diminished the alkali reserve, and that this diminution was greater the further the pressure fell below the critical level. It is well known that nerve cells are particularly sensitive to lack of oxygen, and it seemed natural to expect, therefore, that when blood pressure is below the critical level damage is being done to nervous structures. Such damage was early demonstrated by the experiments performed in the surgical research laboratory. From these observations it was evident that, in addition to the usual treatment of shock by warmth, rest, and fluid by mouth, there was indicated, in case the blood pressure was not raised through these agents, the necessity of raising it artificially to a point above the critical level in order to avoid progressive damage to important structures.

At the time the foregoing facts were obtained a medical officer on the laboratory staff had begun teaching classes the methods of matching the blood of donor and recipient for transfusion and the use of the transfusion set recently adopted by the Army. Late in May the course in resuscitation was organized, and from that time forward, until November 1, 1918, with few interruptions, classes ranging from 6 to 21 members appeared each week to receive instruction in methods of resuscitation.

The three-day schedule which followed was the basis of the preliminary training for resuscitation work:¹⁰

COURSE OF INSTRUCTION FOR PRELIMINARY TRAINING IN RESUSCITATION WORK FOR THE WOUNDED

FIRST DAY

9 a. m. (amphitheatre, main laboratory building):

Introduction—discussion of circulation in relation to shock and hemorrhage.

10.30 a. m. (physiological laboratory):

Demonstration—

Blood pressure instruments.

Standardization of instruments.

Determination of systolic and diastolic pressures.

Artificial respiration—Schaefer method—Bellows.

2 p. m. (physiological laboratory, laboratory building B):

Lecture and demonstration—

Hemorrhage with blood pressure records—

Natural recovery.

Critical further bleeding.

Treatment with salt solution.

Reinjection of blood.

Hemorrhage with replacement by gum-salt solution.

Amount of blood replaceable by gum-salt solution.

Aseptic operation.

SECOND DAY

9 a. m. (physiological laboratory, laboratory building B):

Lecture and demonstration—

Shock blood pressure—

1. Effects of rebreathing and ether.

2. As a cause of acidosis.

3. As a cause of damage to circulatory control.

4. As influencing the effect of ether.

2 p. m. (physiological laboratory, laboratory building B):

Lecture and demonstration—

Treatment of shock—

1. Adrenalin—temporary.

2. Normal salt solution—temporary.

3. Rebreathing expired air.

4. Gum-salt solution (and blood?).

Resuscitation of the stopped heart.

THIRD DAY

9 a. m. (amphitheater, main laboratory building):

Lecture—

Blood transfusion—

1. General considerations.
2. Direct methods.
3. Indirect methods—
 - Unmodified blood.
 - Modified blood.
 - Preserved red blood cells.
 - Use of anticoagulants.
4. Sodium citrate blood mixture.
5. Incompatibility of bloods.
 - Methods of determination
6. Indications for transfusion.
7. Blood transfusion method adopted for A. E. F.
8. Organization of work.

10.30 a. m.:

Practical work (laboratory building B)—

Grouping of donors.

Practical work (surgical laboratory, laboratory building B)—

Preparation of serum for group determinations.

General conference (amphitheater, main laboratory building).

Naturally, as more and more experience was obtained in teaching, in research, and in the work of the resuscitation teams at the front, the methods of instruction became amplified and improved. The following account is based upon the above program, which was followed during the latter part of the period:¹⁰

Three days were devoted to the instruction. On the first day the director of the research laboratory met the members of the class and gave them an outline of the work which they were to perform. He described to them the characteristic features of shock, and brought it into relation with hemorrhage. He then emphasized three points which had practical importance in the treatment of shock: (*a*) Distribution of blood, (*b*) acidosis, and (*c*) sensitiveness to anesthetics. In connection with the concentration of blood in the capillaries, the effect of cold in causing similar concentration afforded a rational explanation of the deleterious influence of loss of heat in augmenting the condition of shock, and gave opportunity for discussing the various means which may be employed to check loss of heat, and to restore to the shocked man the heat which has already been lost. The development of acidosis in shock, when the pressure has fallen below the critical level mentioned above, was the basis for considering the physiology of the circulation in relation to tissue needs, and the importance of keeping the head of pressure in the arteries high, in order to provide a circulation adequate to these ends. The fall of pressure accompanying anesthesia and operation made the basis for discussing the methods of obviating the influences dangerous to the shocked man which attend operation, and the aid which the resuscitation officer may give the surgeon when about to operate on such a man.

After this introductory discussion of shock and hemorrhage, the classes reported to the laboratory, and there had demonstrated the various means of measuring arterial blood pressure. The members of the class were then required to determine blood pressure on a subject, and their results were compared with the results of an expert. If some members made observations markedly discrepant, they were asked to repeat their readings till a common judgment was agreed upon by all. The class was then given instruction in various methods of providing artificial respiration. The work thus far described consumed the morning of the first day.

The afternoon of the first day was devoted to a study of hemorrhage. The method employed was that of gathering the class about a demonstration table, and showing them the blood pressure being recorded directly from an animal under anesthesia. During the course of the demonstration, the effect of hemorrhage in causing a fall of blood pressure was shown and discussed by the class, as was also the natural recovery which usually follows, except in the most severe bleeding. The class was also shown how, after such recovery, the loss of even a small amount of blood might turn the scales against recovery, and the moral of this in teaching, that every effort should be made to avoid absolutely any unnecessary loss of blood from wounded men, was strongly emphasized. After the blood pressure had been seriously lowered by hemorrhage, the purely temporary effect of salt solution injected into the veins was compared with the permanent effects which could be obtained when the blood taken from the animal was reinjected. Later, hemorrhage was again produced, until the pressure was very low, and the volume thus subtracted from the animal was replaced by Bayliss's solution of gum acacia 6 per cent in sodium chloride 0.9 per cent. The permanent rise of pressure which this solution gave was compared with the temporary rise resulting from the injection of pure salt solution. The difference between the two afforded opportunity for discussing with the class the claims made by Bayliss for his colloidal preparation.

In order that the possibilities of the use of gum-salt solution as a substitute for blood volume might be realized, 60 per cent of the estimated blood volume was removed by venesection, with aseptic precautions, from a dog under anesthesia, and the amount replaced by the warm colloidal solution, introduced slowly. With only two exceptions in the whole series of demonstrations it was possible to show the animal the next morning to the students, and even two or three weeks later, in perfectly normal condition. The importance was pointed out by using the artificial solution to replace blood as early as possible after the blood was lost.

The second day was wholly devoted to demonstrations as to the nature of shock, and to discussions between the instructor and the members of the class regarding the phenomena as they occurred. Two methods were employed to bring about the state of shock. Early in the instruction shock was induced by a persistent low pressure caused by increased intrapericardial pressure. Later, shock was induced as a result of tissue damage. By testing with the Van Slyke apparatus samples of blood taken before shock was induced, and after a low pressure had been developed, the influence of low pressure in causing acidosis was demonstrated. In this connection the critical level of a falling

blood pressure, and the urgency of not permitting the pressure to remain long below this level, were again emphasized. The failure of blood pressure to rise after it had been kept low through prolonged intrapericardial pressure, showed the damage to the control of the circulation induced by the insufficient supply of oxygen. Naturally, these demonstrations required some hours for their completion. During this time the physiology of the circulation, the function of high arterial pressure, the change in the circulation wrought by low pressure, the effects of a low pressure in diminishing the oxygen delivered to the tissues, the nature of the consequent acidosis, and the theories of shock were discussed by the instructor and by the members of the class. The exercise was as informal as possible, and, when the classes were small, there was no restraint manifested by the members in asking questions, and in bringing out points which seemed to require further consideration. There was definite advantage thus obtained by giving time for observations and ideas to get a firm setting in the minds of the students.

During the afternoon of the second day the treatment of shock was considered, and, as far as possible, demonstrations were given on various suggested agencies. The temporary influence of adrenalin was recorded as well as the temporary rise obtained by injecting normal salt solution. The rebreathing of expired air was shown to have no value or even a harmful effect. The rise of blood pressure through the use of colloidal solution or blood was then discussed. If the state of shock had not continued for too long a period, so that tissues were disastrously injured, it was possible to demonstrate the permanent rise of arterial pressure which could be obtained by the injection of such fluid.

The effect of ether in causing a striking fall of arterial pressure, when it is administered even to a degree which is barely sufficient to abolish simple reflexes in the shocked organism, was demonstrated. To some classes the markedly different effect of nitrous oxide and oxygen as an anesthetic was shown; through this agency it was possible to produce the same degree of anesthesia as that produced by ether with no fall of blood pressure whatever.

Finally, the animal, which had been in a state of shock even for 15 or 16 hours, was killed by asphyxiation; the recording apparatus showed that the blood pressure had fallen to zero, and that the heart and respiration had ceased acting. Now adrenalin in salt solution was injected into the carotid artery, the heart was massaged through the chest wall, and artificial respiration was administered, and in a few moments the blood pressure usually mounted to 150 mm. of mercury, where it was sustained sometimes for many minutes, with no indication of cardiac failure. This demonstration was made the basis for considering the use of a therapy sometimes employed in stimulating the heart in order to raise arterial pressure. It seemed clear from the demonstration that there was no indication of cardiac failure as an essential causal factor in shock.

After the first two days had been spent in becoming acquainted with the physiology of hemorrhage and shock and with the essential disturbances wrought in the organism by conditions which these states induced, the classes were taught, on the third day, the practical methods of dealing with these states. The instruction consisted in discussion of the fundamental principles underlying the transfusion of blood, especially with reference to the tech-

nique employed, and to reactions which might result if donor and recipient do not belong in proper blood groups in relation to one another. The surgical service had previously selected the method of employing citrated blood; the principle of this method was described, and the transfusion set used in carrying out the method was demonstrated. Since the ease of transfusion depends largely on the condition of the needles which are used, the care of the needles was described in full. The indications for transfusion were then again considered with reference not only to the experimental work of the previous days, but also with the reference to other resuscitation measures which are employed; and finally the proper organization of activity in a resuscitation ward was presented.

After hearing this discussion the class went to the laboratory, where they were divided into groups; one group engaged in matching their own blood against type sera, another in sharpening needles and learning practically the method of keeping needles in proper condition, and another in using the transfusion set on an anesthetized animal. In this last experience the blood was removed from the jugular vein on one side and introduced into the jugular vein on the other. A long exposure of the veins permitted many repetitions of the experience on the same animal. After these exercises there was no reason why any member of the class should have excuse for not being able to employ intelligently the transfusion set.

In the afternoon of the third day the class was taken to Base Hospital No. 17, Dijon, where they engaged in grouping the blood of patients, and, when possible, in withdrawing blood which was later used for the preparation of the sera sent out in the transfusion sets. Thus such members of the class as had not had previous experience in "needling" human veins had opportunity of learning under supervision.

The members of the resuscitation teams were almost exclusively selected from the medical personnel of base hospitals. The theory of this arrangement was that these men would return to their stations, and there each one would associate with himself an orderly and a nurse, who would go to a forward hospital in times of activity to form one of two teams to work in the resuscitation ward of that hospital. Practically, this scheme worked well in certain cases; in other cases, however, the prospective activity was anticipated by the commanding officer of the base hospital, and objection was raised to the separation of the medical officer for forward work at a time when the staff of the base hospital might be heavily burdened. The consequence was that, in spite of the large number of men from base hospitals who were trained, it was difficult to get a sufficient number of resuscitation teams, and in some degree the shock wards of forward hospitals were manned by persons who had not been trained in this laboratory.

Ever since the evidence had been obtained in May, 1918, of the progressive damage done to the control of the circulation through persistence of low blood pressure, emphasis was laid on the early treatment of shock. Late in May the director of the laboratory visited the divisions then in the line, the 26th, 42d, and 32d, and spoke to the medical officers of these divisions on the importance of dealing early with the conditions presented by the shocked men. Fortunately, the simple measures of rest, warmth and hot fluids given by mouth are often

highly effective, and can be used near the fighting lines. These measures, with proper blanketing, will greatly reduce the degree of shock, and if consistently employed will give the badly wounded the best opportunity in the stress of transportation. Repeated efforts were made to bring instruction to the medical officers of divisions—the first officers to care for the badly wounded—but these efforts were largely fruitless. Reports coming from several sources revealed that during the cold weather of late October and November the wounded were being sent on long ambulance journeys with improper blanketing, due, not to lack of blankets, but to improper arrangement of them. Clearly there might have been more satisfactory treatment of the wounded if methods of resuscitation had been more thoroughly taught to the divisional medical officers.

To some extent it was possible to reach these officers in the classes at the Army Sanitary School, Langres; every month one or other member of the teaching staff presented to these classes a brief summary of the work which was given in detail to the classes that came to the laboratory. Late in October, 1918, arrangements were made to have these classes sent in squads to Dijon for more thorough instruction.

In connection with the activity of resuscitation teams, it was deemed advisable to have some sort of oversight of the use of the information which had been given them and the methods which they had been taught. For this reason visits were made to hospitals north of Chateau Thierry in August and in the neighborhood of the St. Mihiel salient in September by the director. The hospitals in the region west of Verdun were visited by an officer of his staff. It was early found that the corps consultants in medicine naturally took upon themselves the function of continuously overseeing the work of the resuscitation teams. By their cooperation, and also by the visits made to the front by members of the laboratory staff, information was obtained as to difficulties which were being encountered, and suggestions were offered as to means of meeting these difficulties.

WATER SUPPLY

After September 27, 1918, when the water-supply section of the central Medical Department laboratory was organized, special training in water-supply work was given to the division water-supply personnel.¹¹ The instruction was practical in character and related more particularly to water surveys, proper methods of determination of water supplies, and the simple chemical tests to be used to check and supervise chlorination.^b

SEROLOGY

The special course in serology was instituted for the purpose of standardizing, so far as possible, the Wassermann technique and giving instruction to laboratory officers who would be required to do this work as part of their routine duties.⁹ The centralization of Wassermann work in a few laboratories was desirable, but the unavoidable delays in mails and lack of transportation for courier service prevented the degree of centralization that was desirable.

^b For a full discussion of this subject see Vol. VI, Sanitation, sec. "In the American Expeditionary Forces," Chap. VII—Ed.

GAS INSTRUCTION FOR DIVISION MEDICAL GAS OFFICERS

It proved necessary to give to medical officers who were to become divisional medical gas officers instructions in the professional care of gas casualties. This was authorized August 29, 1918.⁷ Subsequently, as division medical gas officers were appointed, each was sent to the school of pharmacy of the University of Paris (École de Gaz) for a four-day course of instruction before being assigned to his respective division for duty.

For details concerning this school course, as well as additional instructions which medical gas officers received, consult Volume XIV of this history.

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- (2) General organization project, A. E. F., July 10, 1917. On file, general headquarters, A. E. F., Washington, D. C.
- (3) Report of the assistant chief of staff, G-5, G. H. Q., A. E. F., on the operations of G-5, made to the chief of staff, A. E. F., June 30, 1919. On file, general headquarters, A. E. F., Washington, D. C.
- (4) Report on Medical Department training in the American Expeditionary Forces, undated, by Col. B. K. Ashford, M. C. On file, Historical Division, S. G. O.
- (5) History of the Chemical Warfare Service, American Expeditionary Forces, Vol. I, 8. Copy on file, Historical Section, Army War College. Also: Personal record, Maj. Walter M. Boothby, M. C. On file, Personnel Division, S. G. O.
- (6) Report of the Medical Department activities, First Depot Division, St. Aignan-Noyers, undated, made to the chief surgeon, A. E. F., by Col. O. G. Brown, M. C. On file, Historical Division, S. G. O.
- (7) G. O. No. 144, G. H. Q., A. E. F., August 29, 1918.
- (8) Report from Col. J. F. Siler, M. C., director of laboratories and infectious diseases, A. E. F., to the chief surgeon, A. E. F., undated. Subject: Activities of division of laboratories and infectious diseases, from August, 1917, to July, 1919. On file, Historical Division, S. G. O.
- (9) Report from Maj. B. Jablons, M. C., to office of director of laboratories, A. E. F., American Post Office No. 721 France (through commanding officer, central Medical Department laboratory), May 14, 1919. Subject: Report on teaching of wound bacteriology.
- (10) Historical Record of the Services of the Laboratory of Surgical Research, American Army, at Dijon, 1918, by W. B. Cannon. On file, Historical Division.
- (11) Report of water analysis work at the central Medical Department laboratory, Dijon, France, January 25, 1919, by Capt. H. B. Hommon, S. C. On file, Historical Division S. G. O.

CHAPTER X

ARMY SANITARY SCHOOL

MEDICAL SECTION

ORGANIZATION AND INSTRUCTION

The Army Sanitary School was organized in accordance with the general school project for the American Expeditionary Forces, involving army and corps schools and divisional training, which was approved August 30, 1917.¹ (See pp. 571 and 572, in the preceding chapter.)



FIG. 33.—Army Sanitary School, A. E. F., Langres

The original plan of conducting this school at the 2d Replacement Division of the First Army Corps, together with other Army schools, and of employing it for the training of instructors for corps schools, was never extensively carried out,² but in October, 1917, the Army Sanitary School, among other Army schools, was ordered to be established at Langres.³ The commandant reported for duty November 1, 1917,⁴ and the school was opened December 3, 1917.⁴

While, from time to time, a few graduates of the school were recommended, in accordance with the original plan, as instructors for corps schools, the major

purposes of the Army Sanitary School, as finally evolved, were: (1) To train selected officers from each division, who would return to their organizations and instruct their colleagues; (2) to collect information concerning the work of the Medical Department in war and to distribute this information in mimeographed pamphlets throughout the American Expeditionary Forces.⁴ (See Appendix.) For the accomplishment of these purposes, courses which had been proposed by the commandant and approved by the chief surgeon, A. E. F., were employed.⁵

When a copy of the original memorandum for training medical personnel, American Expeditionary Forces, reached the Surgeon General, it called forth the following suggestions concerning the coordination of training of Medical Department personnel at home and abroad.⁶

1. In connection with your letter to General Birmingham of November 12, 1917, on the subject of Medical Department training overseas, and the attached data, including the general scheme of training all troops overseas and the detailed course for medical officers in France, the following information is furnished for your information as to the nature of the instruction being given in this country and for consideration as to the proper relation between it and the training done abroad.

2. Training of the Medical Department in the United States is based on a comprehensive plan to reach all personnel, commissioned and enlisted, wherever they may be serving. All are being materially benefited. The relative degree of efficiency depends on local opportunity, equipment, and thoroughness of instruction and supervision.

The instruction everywhere is coordinated, and is the same where conditions permit.

A certain scope of basic information is necessary for all officers and for all enlisted men. This is approximately the same in all the courses later referred to, but the time allotted thereto is not always the same for different courses preparing for different varieties of duty.

3. Instruction is given through the following channels:

(a) Departmental. Required per circular letter, Surgeon General's Office, of May 14, 1917, to all department surgeons.

(b) Medical officers' training camps. Required per circular letter, Surgeon General's Office, to commandants of medical officers' training camps, dated May 15, 1917.

Also by Special Regulations 49a, War Department, 1917.

(c) In all organized divisions. Required per circular letter, Surgeon General's Office, to all division surgeons, dated October 3, 1917.

(d) In all base and general hospitals. Required per letter, Surgeon General's Office, of October 15, to all hospital commanders.

This letter was further supplemented by memorandum, Surgeon General's Office, of November 15, to all hospital commanders.

(e) For the training or elimination of all substandard medical officers. Required per letters, Surgeon General's Office, to all department and division surgeons, and to all hospital commanders. Both letters dated December 14.

4. The so-called basic course of three months in training camps was developed primarily for the training of sanitary personnel for service with fighting troops in the zone of operations. This need has now largely been filled by the creation of most of the sanitary organizations required for the troops authorized under existing law.

However, a considerable number of officers and men are continually needed for replacement purposes, and enough are being given this basic course to meet all such needs. This three months' course is also more thorough and satisfactory than the special courses of two months, later referred to. As all personnel is conceivably liable to this service with fighting troops at the front, if time permitted all would receive this three months' course and be given any special instruction necessary to lines of communication formations in addition.

After a four months trial of the same, Colonels Page, Ashburn, Persons, Bispham, and Lieutenant Colonel Bingham, commanding the several medical training camps, in conference decided that the basic course for such camps, prescribed in Special Regulations 49a, met all needs and should not be changed. It has now been tried out for seven months and no need for change has as yet been presented in this country.

5. A shorter course than the so-called basic course is given to personnel to be assigned to duty with formations intended for line of communications work. This course is of two months. It leaves out a considerable amount of training which relates especially to service with fighting troops, and at the same time adds somewhat to the professional training.

Present plans contemplate that at the conclusion of this two months line of communications course, such organizations as evacuation hospitals and base hospitals will have their personnel as a unit attached as supernumeraries for about one month prior to embarkation at fixed base hospitals. This will give them practical training in hospital management and care of patients. This plan is suspended for the present for lack of available accommodations surplus at any suitable base hospitals.

6. Around the basic course of the training camp, and the condensed course for line of communications service, a number of special schools to supplement the former have been established. These latter are largely professional, but have the purpose of training officers to be specialists along certain lines for military purposes and in the military environment and under its limitations.

The special schools thus already established include:

- (a) School of applied military hygiene and camp sanitation.
- (b) School for military roentgenologists,
- (c) School for military orthopedists.
- (d) School for military psychologists.
- (e) School for military sanitary engineers.
- (f) School for laboratory workers.
- (g) School for veterinarians.
- (h) School for internists.
- (i) School for hospital administrative officers.
- (j) Schools for military surgeons, general and regional.
- (k) Practitioners courses in laboratory work.
- (l) School for military dentists.

* * * * *

(8) (a) The hospital facilities at Medical Officer's Training Camp, Fort Oglethorpe, where there is a general hospital, as at present planned, will aggregate 2,500 beds. But it is proposed to expand this to any such number as may be required to furnish abundant material for clinical courses and adequate instruction. It is well located to be expanded to 4,000 or more beds.

Selected cases are to be sent to Fort Oglethorpe for this purpose from the 10 great camps, with their soldier population of some 400,000, which are located within a night's run of Fort Oglethorpe; which latter will, in addition, have its own population of 35,000 to 40,000 to draw upon.

Cases from overseas will further be sent to the reconstruction hospital to be operated here.

The plan is to make it the greatest clinical center, as well as medical training camp, in the world.

A selected staff of experts, drawn from the best medical centers, will conduct the clinical and other professional work.

(b) At the present time, there are about 1,400 cases under treatment in the general hospital at Fort Riley. No expansion of clinical facilities here, beyond local supply, is contemplated if this training camp can be merged in the one at Fort Oglethorpe, as mentioned in paragraph 10 herewith.

9. Whether or not all basic training can be done in the United States before embarkation depends on the size of the training facilities authorized here.

At this date there are about 2,600 medical officers under instruction in medical officers' training camps, or actually under orders to proceed there.

There are about 8,000 enlisted men of the Medical Department similarly under training at medical training camps, and this number is rapidly to be increased. Ten thousand more drafted men are expected at them on February 15.

The facilities at Medical Officers' Training Camp, Fort Oglethorpe, immediately in sight, are as follows:

Now occupied, cantonments.....	6, 000
Tent camp under rapid construction.....	6, 000
Artillery cantonment just being turned over.....	1, 500
	<hr/>
	13, 500

The facilities at Medical Officers' Training Camp, Fort Riley, immediately in sight are:

Now occupied, cantonments.....	3, 500
Just ready to occupy, cantonments.....	1, 500
Ready in three weeks, gunsheds converted into barracks.....	1, 500
Tentage.....	400
	<hr/>
	6, 900

Total, both camps, 20,400.

10. However, the Medical Department has asked that it be given all of the structures and facilities at Chickamauga Park and Fort Oglethorpe. These are now accommodating over 35,000 officers and men, mostly of line organizations. If all these accommodations become available, the Medical Department will concentrate all training there. In the meantime, it will need to maintain the camp at Fort Riley also.

11. For present purposes, the medical officers' training camp in this country can be counted on for the following:

(1) To give basic training and special instruction to all medical officers hereafter entering the service.

(2) To organize all sanitary formations created in this country, and to fundamentally train the officers and men composing their personnel.

(3) To train more than one-half of all other enlisted men of the Medical Department entering the service.

The remainder will have passed into the service direct to divisions, hospitals, etc., and received their training there.

12. If the Medical Department gets all the accommodations at Chickamauga, it will endeavor to send all enlisted men, as well as all officers, through the training course there.

13. The general plan for the early development of a single great medico-military training center in the United States is embodied in memorandum for General Birmingham, dated January 11, entitled "Final policy for training officers and men of the Medical Department."

14. The general plan of the training committee, General Staff, looks to the separate training of each arm or branch of the service by itself in this country, with combined training of all branches and arms in the camps abroad.

The Medical Department plan agrees with this, except that its personnel under instruction may have the benefit of association with a certain number and type of line troops in this country. If such opportunity for combined training exists in this country at or near the medical officers' training camp, the Medical Department will, to a reasonable extent, take advantage of it.

15. As far as possible, it is believed that nearly, if not all, training in theory, and some at least of the training in practice, should be done in the United States.

On going abroad, the individual should already have received his fundamentals of instruction and be able to intelligently participate at once in the application under special conditions of the general principles he has learned.

16. The school abroad should thus be primarily a school for advanced students, both officers and men, and should further be especially a school of practical application.

17. The general idea of the relation which it would seem desirable should exist between the training facilities of the Medical Department at home and abroad is given in memorandum for General Birmingham, dated December 28, entitled "Training of Medical Department at home and abroad."

18. It is possible that necessities of the service may require that a certain number of uninstructed men, and a still larger number of only partially instructed men, shall be sent abroad from time to time. Insufficient training facilities in this country and shortness of time has made such action necessary in the past.

Such men, of course, will need training overseas in theory and practice, according to the nature and extent of their deficiencies—and for them a suitable course, probably closely approximating the instruction given in this country, should be maintained overseas.

But this last course should be regarded merely as incidental to the main school, which should be one of application for advanced training of personnel grounded in their fundamentals in the United States.

19. The courses of training overseas should take into consideration the courses given here, and information should be required of new arrivals as to the nature and extent of their previous training in this country. Repetition of training in a subject, if satisfactorily understood, and duplication of effort, should of course be avoided.

20. It is requested that the training overseas be so amended as to give full consideration to the preliminary training here.

Also that this office be informed as to the manner in which the courses of training in this country should be amended so as to better coordinate with the training carried out by you and needs of the service abroad.

The following reply to the above communication not only shows clearly wherein and why complete coordination of Medical Department training in the American Expeditionary Forces with that in the United States was impracticable, but it gives a lucid exposition of the purposes and methods of the Army Sanitary School:⁷

The inclosed letter reached me for the first time 24 hours ago, due to the fact that I was on a tour of instruction at the British front with 25 medical officers, and have just returned.

The programs of instruction for the Medical Department in the United States have been gone over with care, and it is believed that the best interests of the service are subserved in the manner in which these programs are being carried out, as there is neither time nor opportunity to train men in many of these subjects where their services are needed in the trenches. A knowledge of the regulations and record keeping of the Army, and a full knowledge of drill with its effect in disciplining officers and men, is keenly appreciated by those of us here who literally are unable to do this work without neglecting exigencies of war service, and, in general, with the exception of some men hurriedly sent with base units, this intensive training has produced remarkable results.

As a matter of fact, when this school was organized a plan of the commandant, submitted to the chief surgeon and approved by him, was to teach the methods necessary for our Medical Department to render its best service in this war, and as this has been a war of trenches up to the present time this phase was chiefly taught. * * * It is believed that in general the plan of this school in France should be continued, namely, that the actual working out of not only our own, but the system of other armies, should be demonstrated practically where war is being carried on, in the front lines of the armies and the lines of evacuation. To this end classes of selected students have been carried up to live for three weeks under these conditions, and the aid of both the French and British Armies has been solicited, not only to give practical talks, where the substance of their remarks could be demonstrated on patients and terrain, but where our officers would be able to visualize the difficulties at the same time that they are furnished with the solution. The school has been unique in that the spirit of the students has been kept at its very highest pitch under the stimulus of the war going on about them. Much of the data they have secured have been obtained from the immediate front, from the first line trenches back to the casualty clearing stations or evacuation hospitals, where they lived during their stay, often under fire and at least once of great assistance to their hosts in sudden emergency.

Shortly after reaching France, while yet division surgeon of the 1st Division, I drew up a program for the instruction of officers and men of the Medical Department. * * * In addition to this program, and at times in substitution for this regular routine, Medical

Department troops were ordered, at favorable opportunities, to take part in combined operations of battalions, regiments, and the whole division, which had, itself, set about vigorous training of its combatant units. In addition to this, medical officers were assembled each Saturday afternoon for instruction at 3 p. m., and in spite of the difficulties attendant thereon, owing to the great lack of transportation in the area covered by the division, 15 miles long and 10 miles broad, there was given an opportunity for interchange of opinion as well as to hear various invited surgeons, chiefly of the French Army, on vital subjects connected with the medical services in war. Some of these lectures, especially those of Aide-Medecin-Major Bernard, were of extreme value. I was fortunate in having an office with the division surgeon of the 47th Chasseurs, Colonel Cultin, who took such a great interest in cooperating with us that he at one time spent an entire day with us inspecting the personnel and equipment in detail of the medical units of his division, the divisional units under his command being brought up in military formation at one spot for this purpose. On another occasion, after a week of hard labor, he staged a field exercise involving battalion aide stations, regimental aide stations, and ambulance company evacuation, at full distances, with dug trenches and marked routes of evacuation; and the influence and instruction received from this officer is reflected in a "Report of a visit made to the French front, per instruction of commanding general, 1st Division," section 3, "Personnel and equipment of regimental and divisional sanitary organizations of French Army"; section 4, "Recommendations of changes which should be made in sanitary organization of the American Army," submitted about September 6, 1917. The success of all of the schools of the 1st Division in rapidly training their men led, I believe, to the establishment of the present school system. Up to this time we had but one ambulance company and field hospital, both of which were involved in serving the routine medical necessities of the division—the one being used to man the divisional camp hospital, the other to evacuate the sick from the numerous cantonments in which it was situated to that hospital. In addition to this, after a preliminary visit of the division surgeon to a French sector in our vicinity, authority was secured from the chief surgeon for a visit of two weeks to the British front of about 20 per cent of our medical officers.

On October 15, 1917, the First Corps Sanitary School was established as one of the corps schools in the heart of the 1st Division, and I was relieved as division surgeon to become its director. Over half of this course was a practical one in the field, many of the so-called lectures being demonstrations. By this time two more ambulance companies and two more field hospitals had reported and were used in field exercises and problems as per program, the intrenched positions being the ones actually dug for the use of the division. Apart from this, a number of Medical Department dugouts were built by the divisional sanitary troops under the general supervision of the Engineer Corps and the French Medical Corps. On November 3, before the course had been finished, it had been the plan to have a course of five weeks for each class in the Corps Sanitary School, but at the end of the first three weeks I was ordered to the Army schools to become commandant of the Army Sanitary School, and left November 3. The course, which was to have continued at Base Hospital No. 18, was in my absence abandoned, due I was informed to an epidemic of scarlet fever there.

I was informed that plans for this school should be based upon the principle that at least 100 medical officers at a time would attend, and that these would be field officers, and I was instructed to make plans which should embrace not only the higher branches of practical work but which should reach out into all of the specialties pertaining to the Medical Department. The plan was to have a division of troops cantoned in the vicinity of the school, which, at the same time it was being trained, would serve as a means of instructing students who came to the school, and that the population of the school area would, in addition to the division, be about 15,000. Upon this information I based the tentative plan, heretofore referred to, but on reaching the school area it became evident that for the present at least the school could not reach the proportions first contemplated by the officers directing the training section. Accordingly, a memorandum to the chief surgeon was forwarded, and approved, and upon the main features of this memorandum the school is now working, although it seems probable that much of the original plan will be attained as the base hospital of 2,000 beds, the division sanitary train complete, medical supply depot, and the hospitals for officers and men, and

dispensaries, are to-day facts, although the base hospital and the division sanitary troops have no relation to this school, with which they are actually in contact. The important change is that the entire class receives the same instruction. Instruction in military medicine is provided by the commandant in addition to his other duties.

The school, at present, is in a comfortable building used as a young girls' school and conjointly with them, but the lack of sufficient accommodations, on the one hand, and the difficulty of getting student officers in the numbers at first contemplated, on the other, somewhat changed the actual working plan of the school as at present carried out. It was decided to make the school a place of instruction for selected medical officers in a position to spread information which could not be attained by the reading of books or papers, or from the divisional or corps schools. Moreover, it was considered that the work of this school should be distinctly separated from training for which other provisions and another bureau was provided. The object of this school was to give information by practical talks and demonstrations as well as tours of instruction at the front and not to attempt long training periods. It was believed that no base or line of communications medical officer could be of such efficiency as the conditions of this war required until he could visualize the scenes and conditions from which his patients came, and vice versa. In this manner the school aimed to coordinate all parts of the medical service and bring about cooperation between front and rear, the lack of which caused much confusion and not a little suffering in times past in the armies of our Allies. After this bird's-eye view of the entire medical department from front to rear, with concentration of attention on vitally important features, all medical officers would be in possession of enough basic knowledge of any part to enable the chief surgeon to call upon anyone to serve in either front or rear. The training of these officers in their specialties could be taken up by some other bureau or be later provided for as a branch of this school. This allowed the staff of the school to concentrate their attention upon the vital and pressing matters connected actually with this war, and it was determined to make this instruction so practical that everything taught could be actually demonstrated. Accordingly the first class was taken to the British front, stopping a few days in Paris to receive a preliminary course in the best known military hospitals of that city, and in the fracture hospital commanded by Colonel Keller, one of the instructors. The British Army invited us to take our course at the school of instruction of the Royal Army Medical Corps for the First Army. We were quartered in a casualty clearing station about $4\frac{1}{2}$ miles from the lines. On the last night of our stay, after heavy bombardment, the class furnished operators to assist in that hospital.

The second class began January 10, 1918, and this time a tour of instruction was arranged with the French and the class proceeded to the school of instruction of medical officers of the Fifth Army. The notes on this course have not yet been completed, but it was an extremely valuable one.

As a result of these two expeditions very strong and lasting relations of cooperation were established between the British and French Armies and ourselves.

The present class is now just completing its course, the third of this school, and has just returned from a tour of instruction in the school of the Royal Army Medical Corps for the First Army, which had been sufficiently varied from the first course to present features not heretofore covered, inasmuch as a most thorough demonstration of all of the lines of communication and base were included, even to the inspection of hospital ships ready to sail for England. The report of these two courses will be forwarded in due time.

The policy of this school at the close of this course will change,^a in that it will be limited to one month, the students will be increased from 25 to 50, 25 having heretofore supplied the demand, but now it is believed that 50 students can be spared from their actual duties at the front. At the conclusion of this course 25 students will be selected, in order of merit and aptitude from this class, to make a two weeks' tour of instruction as other classes have made.

Compared with the large training activities in the United States, the number of students who have passed through this school seems small, but in analyzing its results one should consider its functions. This school has the same relation to the Medical Department as the General Staff School has to the Army. The general instruction in divisions provides for all Medical Department personnel in the field, the corps schools prepared instructors for the

^a See communication from the adjutant general, general headquarters, A. E. F., to the commandant, Army schools, *ra* Army Sanitary School, Mar. 4, 1918, *infra*, p. 622.—*Ed.*

divisions, and the Army Sanitary School (whose number of students is about that of the First British and Fifth French Army schools visited) prepared instructors for the corps schools. As a matter of fact that has been exactly what has happened. Before the Army Sanitary School existed the 1st Division supplied practically all of its instructors. After this the Army Sanitary School provided the main part of the instructors for the Second Corps school. Now with the abolition of the corps schools this army school will provide not only all instructors for divisions directly, but will furnish those for units in the line of communications.

From the first all students to this school are required to take full notes on all lectures, demonstrations, and visits to the units of allied armies; the commandant has accompanied each expedition with at least one, and later two, of the faculty, and has done likewise. At the end of each course these notes are all written into a composite form by the faculty and mimeographed. The proceedings of each course will be furnished each division for permanent record and enough are supplied heads of large medical units and the general staff to secure liaison. Not only this, but it is the intention to place all alumni upon the mailing list of the school for literature in subjects not treated heretofore.

In short, the present system has been based upon the principle that only those matters which could not be secured by instruction in the United States, in divisional areas, and in the corps schools should be handled here. It was long ago felt that corps sanitary schools rather complicated than helped the system of instruction that we were attempting to make possible for medical officers, and in fact these corps schools, not only in the medical department but of all arms, have been abolished. There is no time for drilling, paper work, or supplemental instruction, and as will be seen from the programs, the five great subjects taught are the tactical disposition of sanitary units, military administration of the medical department (meaning thereby the liaison between medical units, administration of organizations in the lines of communication, etc.), military hygiene as applied to this war, military surgery, and military medicine.

In addition to the record of the first course of this school, certain papers and notes are hereto added for information and distribution in the schools of the Medical Department of the United States. Some of these papers refer to lectures and demonstrations in the second and third courses of the school, and one especially—the translation of a lecture by Lemaître—will probably be a classic, inasmuch as he was the first to practice the so-called primitive suture and surgical sterilization of wounds.

Other notable papers, also original and appearing for the first time (as in fact most of these papers do) are: "Notes on the Battle of the Somme," furnished on request of the commandant by Lieutenant Colonel Cordillot, division surgeon of the 18th Division, French Army, made by him from a diary he kept at the time. "The organization and operation of aid stations in army corps and litter-bearer groups," by Aide-Medecin-Major Collin, containing excellent plans for regimental dugouts. "The function, rôle, and methods of the division surgeon," by Lieutenant Colonel Theoris, division surgeon, French Army. "Duties of the regimental medical officer during an advance," by Major Griffin, English regimental surgeon.

It is quite unnecessary to state that all of the material received from the British was so valuable as to make it impossible to point out one in preference to others; but the chief value of these papers lies in the fact that the subject matter therein treated has to a large extent been verified by demonstration. In fact, the course with the French was carried out at an evacuation hospital for a sector of the French lines of 3,000 beds where wounded were being constantly received, and much of the instruction not provided for in the program was given by Professor Lemaître and Professor Leriche in the operating rooms and wards, at all hours of the day and night. It is believed that the surgical experience gained in these demonstrations has already had a tremendous influence in putting into practice one of the greatest advances in military surgery—the primitive and the primitive retarded suture and its limitations. It is unfortunate that larger groups can not be taken to these lines, and more frequently, but, naturally, 25 is the extreme number that can be accommodated at any one time, and, besides, in the future the activity of our own troops will henceforth furnish a large amount of future instruction, this not having been possible heretofore, as it is only comparatively recently that our troops have become consolidated on the line. I can only state the self-evident fact that the excellence and uniformity of the British and French medical service comes mainly from its school system.

In addition to the Army Sanitary School, this school has under its supervision the Army Dental School, with a course of two weeks, and our officers cooperate with them, as theirs do with ours, on those branches of medicine and surgery which affect both. The course is two weeks. There is a director and two assistants—1 colonel, 1 major, and 1 first lieutenant.

The following observations on the school system and programs in the United States are noted. Many of them may be unnecessary, but they are presented for whatever little they may be worth to an organization already so unusually thorough.

1. It is questionable how much of our own perfected plans for open warfare can be utilized in this present war. While manifestly unsafe to neglect tent pitching, equitation, and drill, it is believed that, if other subjects seemingly requiring more time have to be extended, these branches might be called upon to yield some more room for such extension.

2. The paper routine of the Army, knowledge of regulations, manuals, etc., is an important matter which can best be taught in the United States, but if, as it is hoped, simplification of methods of record can be further secured, as appears to be contemplated especially for the zone of operations, still further time could be secured.

3. The importance of the evacuation hospital can not be overestimated. In this war this hospital has become the pivot on which moves the whole medical service of the front, and it is not an exaggeration to say that save in overwhelming periods of activity, which total perhaps 2 or 3 weeks in every 52, the real determinate surgery is done here; that is to say, the surgery of war has apparently moved, if not entirely, certainly to a large extent, from the base and general hospitals to the evacuation hospital.

It is believed, therefore, that this hospital should receive a longer time for consideration in all training areas.

4. Complementary to this, the use of field hospitals in this war has altered. Their utility is fully as great as ever, especially when one considers that they are the mobile hospitals upon which we have to depend in the critical moment of a change to a war of movement. Meanwhile, they are the utmost necessity for sick and gassed cases.

5. The course on rations and mess management is also apparently rather short. This is such a feature in the British Army that a cookery school is called upon to furnish a considerable amount of instruction at their schools.

6. I strongly recommend the incorporation of Cowell's treatment of shock and his Thomas splint drill. It has saved many lives and limbs here.

The rifle splint drill not included herein provides for continuous extension and is a distinct improvement on all previous improvised methods I have seen. When prepared this will be forwarded.

7. I earnestly recommend the teaching of Lemaître's ideas on the primitive suture to all medical officers. While not yet universally used in the French Army, it is spreading with great rapidity and is the treatment par excellence in the First British Army. In fact, I am informed that the English have adopted it pretty generally in all their armies. I have seen its results, and it is being used at our own American front with astonishingly favorable results. The limitations of its practice should be minutely explained and the Carrel-Dakin method should not be displaced from its legitimate application.

8. The work in trench warfare, construction of dugout, etc., might be increased, as in both French and British Armies medical personnel usually dig their own shelter and consolidate their own positions, usually, of course, under the supervision of the Engineer Corps.

9. As far as I was able to determine, no general instruction on skin diseases is being taught. As fully half (some say 60 to 90 per cent) of the medical cases come from skin diseases, scabies and lice, and trench fever, whose proven vector the louse is, thorough instruction on this subject should be contemplated.

10. The faculty of this school is impressed with the fact that the two absolutely new and the most important contributions to the efficiency of the Army by the Medical Department are (a) the excision of devitalized tissue and surgical sterilization of war wounds of the French and (b) the perfection of convalescent depots by the English. Both are examples of active participation by the Medical Department in helping to win the war. As we were reminded in both allied armies, our humanitarian calling we have always and we shall always practice. This is nothing new but the prevention of disease, and the great reduction in number of days absent from the front of sick and wounded is. This economy of men is vividly brought out

by Lemaitre's statement to me that he had returned 897 out of 1,130 men to the front during a period of six months after an average incapacitation of three weeks by means of his primitive or primitive retarded suture; and that of Colonel Miles, in command of a convalescent depot, who told me that 1,500 men were sent direct to the trenches fit for duty each month. The British medical service charges itself with what they call the "wastage" of the Army in men. Therefore, it would be desirable to give the subject of "convalescent camps" more time in the courses back in the United States. A full description of these camps in the British lines will go forward as soon as completed, giving details. The great point made by all was that they must be operated entirely by medical officers.

11. It is believed that the contention of the British that a high-grade man should be selected to the position of regimental surgeon can not be too seriously considered. Aside from high qualities of morals and knowledge of men, he should be a keen diagnostician, to the end that much useless undoing of dressings and mistakes in the destination of patients who are sent according to the diagnosis tag may be avoided or lessened as much as possible. We were told at some large receiving hospitals that the dressings were never disturbed in the cases of certain regiments because the confidence in the diagnosis was absolute, and a man was sent according to that diagnosis, whereas in other cases diagnosis had to be laboriously remade where time was pressing and could be ill afforded.

PROGRAM FOR THE BASE HOSPITALS

The following were the points most insisted upon and practiced during the nine months' observation that we have had in France.

1. For practical purposes all wounds are considered infected, and distinction is no longer made between bullet wounds and shell wounds unless there is not the slightest doubt that the wound was from a nondeformed bullet at medium range. Practically all such wounds are treated by ample exposure, removal of the missile and of the clothing and other foreign bodies blown into the flesh, together with such devitalized tissue as can be determined in the usual manner.

2. A life-saving procedure is the immediate closure at the very front, before transportation to the evacuation hospital, of the large blowing wounds of the chest. If, as is usually the case, no formal operation can be done, the skin should be pulled together and sutured, and if this is impossible a large dressing, covered with adhesive plaster, should be tightly applied.

3. Cushing's method of intervention in wounds of the brain and peripheral trephining, together with removal of such liquified material from the tract of the wound as can be so removed by a No. 7 rubber catheter, is giving the best results in such cases.

4. The necessity for a physician expert in examination of the chest on all chest teams which may have to be sent to the casualty clearing stations to work seems of importance.

5. The conversation officially of the term "shell shock" which is abused, as well as ignorantly used, by badly shaken soldiers, sets in train conditions which lead up to hysteria and malingering. These cases are termed by the British "Not yet diagnosed" (N. Y. D.) and are sent back to a special hospital, generally a stationary hospital, for observation and treatment, their cases investigated and distinction made between concussion and its effects, and plain hysterical conditions, if possible. We have been advised by several good authorities that it would be justifiable to do a lumbar puncture at the casualty clearing station or first surgical hospital at which these cases are received to determine the presence of blood in the cerebrospinal fluid.

6. Brain cases should not be considered as nontransportable save when in extremis, as such cases travel well before operation and are impossible to move thereafter. The best place for them is in the rear of the evacuation hospital, at some hospital specially designated for the treatment of such injuries.

7. Fracture hospitals should be established in the rear of the evacuation hospital and among the various appliances for treatment, Sinclair's hammock frame for fractures of the pelvis, perineum, and those fractures of the buttocks and hip which prohibit the application of a Thomas splint, is considered to give the best results, both as regards comfort to the patient and facility for treating the wound.

In conclusion I have observed that many of the surgeons accredited to the fighting force in France are lamentably deficient in a correct knowledge of anatomy, and some rapid method, such as the teaching on sectional plates, seems imperative. Many physicians called upon to

do work in the evacuation hospitals, not to speak of those in the rear, while well versed in the special anatomy for formal operations in civil life, have shown themselves lacking in a sufficient knowledge of the relative position of bones, muscles, nerves, veins, and arteries at different levels of the extremities, as well as the functions and distribution of nerves and the insertion and functions of muscles. A relatively little understood anatomical guide is the arterial and nerve supply of muscles. These matters become of first importance in the excision of devitalized tissue which might prevent infection but leave the patient with a functionless limb.

8. The peculiarly close relations which to-day exist between Roentgenology, bacteriology, and surgery is noted, the radiologist being called upon to act always in an adjoining and connecting room to the operating room, frequently in the operating room itself with a localizer, side by side with the surgeon, the surgeon often being obliged to use the fluoroscopic bonnet and the aluminum top table to rapidly judge of the position of projectiles. This mechanical aid to the surgeon has been complemented, especially in the French hospitals, by an expert bacteriologist, who whenever possible cultures the wound before closing and determines the presence or absence of streptococcus, etc.

The great necessity for the training of base hospital medical officers in military administration, not only to the end that they may be able better to conform, and to make their hospital conform, to military life, but because they will be called upon frequently to reinforce units in the advance zone where everything depends on not only professional ability but an unbending spirit of discipline and ability to exact that discipline of others.

This memorandum has been shown to Colonel Stark, chief surgeon of the advance section, lines of communication, of our Army, and the faculty of this school, and they approve of the contents.

BAILEY K. ASHFORD,
Colonel, Medical Corps, United States Army,
Commandant, Army Sanitary School.

Dated March 29, 1918.

PROGRAM OF FIRST SESSION, ARMY SANITARY SCHOOL

(December 3, 1917, to January 5, 1918)

Class reported on December 2, 1917, Army Sanitary School, and left for Paris, December 3, 1917.

Dec. 4:

7 a. m. to 8 p. m.---- Clinic and lecture and demonstrations at fracture hospital, V. R. 76. By Lieut. Col. W. L. Keller, M. C., United States of America.

Dec. 5:

9 a. m.----- Ward dressing demonstration by Carrel-Dakin method. By Doctor Chutro, at Lycee Buffon.

4 p. m.----- Clinical lecture and demonstration of cases. By Professor Babinski, Lycee Buffon.

Dec. 6:

9 a. m.----- Half of the class went to Beaugon Hospital to a lecture by Professor Tuffier on the organization of the French medical service and to see him operate thereafter. The other half to a special operative clinic by Professor Chutro, at the Lycee Buffon.

2 p. m.----- Visit to Val-de-Grace Medical Museum.

Dec. 7:

9 a. m.----- Visit to St. Nicholas Hospital to see ambrine treatment applied and the injection of specially prepared guaicol and oil from the diminution of scar tissue.

Dec. 8:

9 a. m.----- Visit to Major Blake's hospital, No. 6 Piccini.

2 p. m.----- Visit to American ambulance at Neuilly.

December 9: Left for the British front.

December 10: Arrived at casualty clearing station 33, where the school of instruction for the Royal Army Medical Corps of the 1st British Army was in session. The students remained at this center from December 11 to December 23, inclusive, and a separate program for this course is hereby appended.

Program of first class Field Service School for Medical Officers, A. E. F., in the British lines, 1917

Hour	Monday, Dec. 10	Tuesday, Dec. 11	Wednesday, Dec. 12	Thursday, Dec. 13	Friday, Dec. 14
8.30 a. m.		Physical drill	Physical drill	Breakfast	Physical drill
9 a. m.		Breakfast	Breakfast	Visit to the front-line medical units (No. 1, 42d Division; No. 2, 46th Division; No. 3, 46th Division; No. 4, 11th Division; advance dressing station; regimental aid posts. Inspection of dug-outs, trench latrines, etc.	Breakfast
10 a. m.		Opening address	Duties of regimental medical officer		Summary of front-line methods
11 a. m.		Practical splinting, "Thomas drill"	Practical splinting, "Thomas drill"		Conference
12 m.		Lecture, "sick wastage"	Lecture, "Wound shock"		Practical splinting
1 p. m.		Lunch	Lunch		Lunch
2 p. m.	Arrival of class	Demonstration of practical sanitation and lecture	Lecture, "Functions of field ambulances"		Lecture, "Radiology"
3 p. m.			Lecture, "Customs of the service"		Organization of casualty clearing stations
4.30 p. m.		Tea	Tea	Tea	Tea
5 to 8 p. m.	Clinical demonstrations and surgical operations as opportunities arise at Nos. 33 and 1 casualty clearing stations				

Hour	Saturday, Dec. 15	Sunday, Dec. 16	Monday, Dec. 17	Tuesday, Dec. 18
8.30 a. m.	Physical drill	Breakfast	Physical drill	Physical drill
9 a. m.	Breakfast	Church parade	Breakfast	Breakfast
10 a. m.	Visits to casualty clearing stations Nos. 18 and 23. Inspection of No. 23 casualty clearing station	Visit to ordnance	Lecture, "War surgery"	Lecture, "Trench fever"
11 a. m.			Practical splinting	Lecture, "Organization of the medical services"
12 m.			Lecture, "Chest wounds"	Lecture, "Wound shock"
1 p. m.	Lunch	Lunch	Lunch	Lunch
2 p. m.	Nos. 30 and 57 casualty clearing stations		Demonstration of field cookery at First Army School of Cookery	Demonstration, "Vapor baths"
3 p. m.				Lecture, "Medical clerking and records"
4.30 p. m.	Tea	Tea	Tea	Tea
5 to 8 p. m.	Clinical demonstrations and surgical operations as opportunities arise at Nos. 33 and 1, casualty clearing stations	Conference in the C. C. S., D. M. S., consulting surgeon	Clinical demonstrations and surgical operations as opportunities arise at Nos. 33 and 1, casualty clearing stations	

Program of first class Field Service School for Medical Officers, A. E. F., in the British lines, 1917—Continued

Hour	Wednesday, Dec. 19	Thursday, Dec. 20	Friday, Dec. 21	Saturday, Dec. 22	Sunday, Dec. 23
8.30 a. m.	Physical drill	Physical drill	Breakfast	Physical drill	8 a. m. Breakfast
9 a. m.	Breakfast	Breakfast	9.50 a. m.	Breakfast	
10 a. m.	Lecture, "War surgery"	Lecture, "Wound infection and their complications"	Visit to Red Cross depot	9.30 a. m. Lecture, "War surgery"	Ambulance to station; departures
11 a. m.	Lecture, "Obscure medical diseases of the war"	Lecture, "Wound shock"	10.45 a. m. No. 39 stationary hospital	Lecture, "Relation of chaplain's department to medical services"	
12 m.		Lecture, "Convalescent depots, line of communications organization"	Lecture (brief), "Treatment of N. Y. D. N."	Recent Passchendaele experiences	
1 p. m.	Lunch	Lunch	Lunch—molasses	Lunch	
2 p. m.	1.20 p. m. Seventeenth advance depot medical stores, baths, laundry; inspection of field ambulance equipment	Visit to corps rest station and scabies hospital	Surgical wards and infections	Visit to Haudain staff; lecture	
3 p. m.			Merville laboratory	Fallacies of evidence, especially medical	
4.30 p. m.	Party of surgeons to No. 1 casualty clearing station	Tea	Tea	Resume conference	
5 to 8 p. m.	Clinical demonstrations and surgical operations as opportunities arise at Nos. 33 and 1 casualty clearing stations				

December 23 to 25: En route to the Army Sanitary School.

PROGRAM AT THE ARMY SANITARY SCHOOL, FIRST SESSION

December 25: Arrived at the Army Sanitary School from the British front.

During the period of eight days remaining, from December 26, 1917, to January 5, 1918, inclusive, a period of three complete days was devoted to practical gas instruction, and in the remaining seven days each student was required to write a complete account of his course from notes taken on the tour of instructions just completed. In addition to this, the following lectures were delivered.

Three hours, by Professor Lemaitre, who came on from the Fifth Army Sanitary School at the request of the commandant to give a lecture on the "Primitive suture of war wounds."

One hour on the effects of new ordnance, by an officer of the Ordinance Corps.

Two hours on diverse subjects, by Colonel Ashford.

Three hours, by Medecin-Aide-Major Aime, of the French Army, on various phases of war surgery.

PROGRAM OF INSTRUCTION FOR THE SECOND SESSION, ARMY SANITARY SCHOOL

Class reported January 9, 1918, at Army Sanitary School, Left for Paris, January 10. Began course, January 11, 7 a.m.

At the V. R. 76 fracture hospital by Lieut. Col. W. L. Keller, M. C., instructor in military surgery, demonstrator, and lecturer.

Jan. 11:

- | | |
|--------------------------|--|
| 8.30 to 10.30 a. m.----- | Ward instruction in the treatment of fractures with the different types of splints recommended for use in the United States Army. |
| 11 to 12 m.----- | War wounds; wound bacteriology; primary suture—retarded primary suture and secondary suture; traumatic shock. |
| 1 to 2 p. m.----- | Fractures, treatment, and prognosis. Extracts from Doctor DePage's paper on fractures of the femur. Conclusions on fractures of the femur. Interallied Congress. |
| 2 to 3 p. m.----- | The use of Dakin's solution, dichloramine-T., and eusol in the treatment of suppurating wounds. Flavine chemical composition and germicidal properties. |
| 3 to 4 p. m.----- | Diagnosis in chest conditions. Extracts from papers by Duval, Tuffier. |
| 4 to 5 p. m.----- | Radiology. |

Jan. 12:

- | | |
|---------------------------|---|
| 8.30 to 9.30 a. m.----- | Ward dressings (staff). |
| 9.30 to 10.30 a. m.----- | Chest and abdomen. |
| 10.30 to 11.30 a. m.----- | The new German asphyxiating gas. |
| 11 to 12 m.----- | Care of joints, muscles, tendons, and tendon sheaths during treatment of fractures. |
| 1 to 2 p. m.----- | Extracts from paper by Professor Wilhelm on the treatment of joint injuries. Conclusions of Interallied Congress. |
| 2 to 3 p. m.----- | Surgery of the head and spine; conclusions; review of two days' work. |
| 3 to 4 p. m.----- | Gas gangrene; tetanus. |
| 4 to 5 p. m.----- | Radiology. |

January 13: En route to the school of instruction for medical officers, Fifth French Army.

On our arrival we were given the following general instructions: The class at this school for this course consisted of 50 medical officers—28 American and 22 French. These were divided into two American groups and two French groups. Instruction was all in French, and after dinner each night the commandant and two other officers, being the only ones who understood the language, rehearsed the substance of the lectures during the day.

Thus the instruction consisted of all the day and the evening up until 11 o'clock at night; and officers were frequently called in groups to witness operations until 2 a. m. The clinical work in wards and operating room in the daytime between lectures, as well as laboratory demonstrations, completely filled every hour of the day save those set aside for meals. Conferences of the French averaged at least two hours in length. These demonstrations were provided for as follows:

SCHEDULE FOR THE DOCTORS VISITING THIS HOSPITAL TO WITNESS THE VARIOUS PRACTICAL DEMONSTRATIONS

In order to avoid overcrowding, which would be produced necessarily if all the doctors should present themselves at the same time at the same service, it is recommended that they group themselves in the following order:

First, visits to the surgical services.—Operating group No. 10, service of M. M. Leriche (fractures) and Roux-Berger (visceral wounds). From the 14th to 19th inclusive, American doctors; from the 21st to 26th, inclusive, French doctors. Operating group No. 15, service of M. Lemaître (wounds of soft parts). From the 14th to 19th, inclusive, French doctors; from the 21st to 26th, inclusive, American doctors.

Visits and demonstrations of wounded will take place each day from half past 10 till 12 in the morning.

Second, practical demonstrations.—These will begin January 16 and will be held at 3.30 in the afternoon.

For the purpose of the above, doctors will divide into four groups—two groups American and two French.

	Service of trench foot	Pathologic histology	Bacteriology	Radiology
Jan. 16.....	First group.....		Third group.....	
Jan. 17.....		Fourth group.....		
Jan. 18.....	Second group.....		Fourth group.....	
Jan. 19.....		First group.....		Second group.
Jan. 21.....	Third group.....		First group.....	Fourth group.
Jan. 22.....		Second group.....		Third group.
Jan. 23.....	Fourth group.....		Second group.....	
Jan. 24.....		Third group.....		First group.

GENERAL INSTRUCTIONS

1. The conferences, according to the program appended, will take place at 9 o'clock in the morning and 2 o'clock in the afternoon, in barrack No. 64.

2. Special exercises or demonstrations in surgical, medical, and laboratory centers will be announced, as the occasion may arise, in the assembly hall in the officers' mess.

3. Meals will be served in the various messes at half past 8 in the morning, midday, and 7 p. m.

4. Visiting officers have at their disposal: (a) The shower baths situated near the mess; (b) the scientific and literary library of the officers' mess; (c) the post exchange of the hospital and of the officers in the village of ———.

5. There is a post office in the hospital near the laboratory barrack. Letters should be posted in the evenings before half past 7 in order to leave the next morning. The military address of the hospital is: Ambulance 12/1, Scientific Group, Postal Sector 1224.

Service de Sante Militaire

CONFERENCES ON WAR SURGERY WHICH WILL BE GIVEN IN THE RESEARCH AND INSTRUCTION CENTER OF ——— FROM THE 14TH TO THE 27TH OF JANUARY, 1918

January 14 (9 a. m.): General consideration on wounds of war. By the consulting surgeon to the Army.

January 14 (2 p. m.): Pathology and physiology and anatomy, common to wounds; spontaneous evolution; process of cicatrization. By the associate professor in the faculty of medicine of Lyons, chief of a laboratory group.

January 15 (9 a. m.): Bacteriology of wounds, microbes and the habits of aerobes; supuration. By a medical officer of the Pasteur Institute.

January 15 (2 p. m.): Bacteriology of wounds, microbes and the habits of anaerobes.

January 16 (9 a. m.): Antitetanic serotherapy. By the associate professor of the faculty of medicine, surgeon of Paris Hospital, consulting surgeon of the Army.

January 16 (2 p. m.): Gas gangrene, clinical forms, and treatment. By the chief of a surgical group.

January 17 (9 a. m.): Treatment of wounds of the soft parts in general by primitive suture; indications, contraindications, and technique. By the chief of a surgical group.

January 17 (2 p. m.): Disinfection and secondary suture of wounds; indications and various methods of technique.

January 18 (9 a. m.): Abdominal wounds in general. By the associate professor of faculty of medicine of Paris; consulting surgeon of an Army corps.

January 18 (2 p. m.): Frost bite of the feet, and trench foot. By the associate professor of Val-de-Grace, medical chief of an evacuation hospital.

January 19 (9 a. m.): Shell shock. By the associate professor of faculty of medicine, physician to the Hospital of Paris, chief of a medical group.

January 19 (2 p. m.): Fresh wounds of articulations. By the associate professor of the faculty of medicine of Lyons, chief of a surgical group.

January 20 (9 a. m.): The wounds of the brain.

January 20 (2 p. m.): General discussion by surgeons—regimental, ambulance, evacuation hospital, base hospital, and biologists—on traumatic shock. Presided over by Charles Richet, member of the Academie Francaise; originator of the theory of anaphylaxis.

January 21 (9 a. m.): Complications, secondary and late, of wounds of the cranium and brain.

January 21 (2 p. m.): Spirochetal jaundice.

January 22 (9 a. m.): Wounds of nerves.

January 22 (2 p. m.): The open fractures of the diaphysis; principles of their early operative treatment.

January 23 (9 a. m.): The open fractures of the diaphysis; principles of their orthopedic treatment.

January 23 (2 p. m.): The wounds of the pleura and the lungs. By a surgeon of the Paris hospitals, chief of a surgical group.

January 24 (9 a. m.): Indications and general technique of amputations due to fresh wounds of war. By the chief of auto-chir.

January 24 (2 p. m.): The technique of radiologic assistants to the surgeon in the surgical units of the advance; the demonstration of apparatus and methods. By the associate professor of the faculty of medicine of Lyons, chief of the base laboratory of radiology.

January 25 (9 a. m.): The wounds of the eyes. By an ophthalmologist of the Paris hospitals, chief of the ophthalmological center of a surgical group.

January 25 (2 p. m.): Lecture by an officer of the General Staff of the French Army on the tactical disposition of medical units of the advance and lines of communications.

January 26 (9 a. m.): Wounds of the blood vessels.

January 26 (2 p. m.): Organization and administration of first-aid units and divisional ambulance companies. By an associate professor of the faculty of medicine of Nancy, chief of a divisional ambulance.

January 27 (9 a. m.): Gas in war; general review; treatment of intoxication produced by asphyxiating gases. By the chief of medical legal center for the Army.

January 27 (2 p. m.): Visit to Rheims and regimental and field ambulance stations therein.

January 28 (9 a. m.): Visit to the trenches by the two groups of American medical officers.

January 29: Visit to the trenches of the other two remaining groups of American medical officers.

January 30: En route to Paris. On the way, visit to hospitals and a medical legal center for the French Army.

January 31 (9 a. m.): Operative clinic; removal of projectiles from healed chests on the X-ray operating table at Hospital 16, Rue Leroux.

January 31 (4 p. m.): Plastic surgery.

(1) Conference, with the following subprogram, on the mutilation of the palate and vestibulo-palatine region of war wounds.

(2) Operative clinic:

(a) Restoration of lower lip by autoplasty.

(b) Reparation of a loss of substance from the cranium by cartilaginous transplanting.

(c) Reconstruction of the cheek bones by cartilaginous graft.

(d) Restoration of the lower eyelid.

(e) Rhinoplasty.

(f) Various plastic operations.

February 1 (9.30 a. m.): Demonstration of wound dressing by the Carrel-Dakin method.

February 1 (4 p. m.): Nerve lesions incident to war wounds.

February 2 (8.30 a. m.): Special operative clinic. At the Lycee Buffon.

February 2 (2 p. m.): Inspection of the Val-de-Grace Medical Museum.

February 3: En route from Paris to the Army Sanitary School.

PROGRAM AT THE ARMY SANITARY SCHOOL

(NOTE.—The total number of hours concerned in instruction each day was from 5 to 6 hours; but the officers completed a full 9 hours each day by writing up their notes on the visit to the front.)

- Feb. 4:
 9.30 to 11.30 a. m.----- Field messages.
 3.10 to 4.30 p. m.----- Tactical problems (staff college).
- Feb. 5:
 9.30 to 11 a. m.----- Personal hygiene.
 1.15 to 4.30 p. m.----- Gas instruction (at Army Sanitary School).
- Feb. 6:
 8.30 to 10 a. m.----- Obturators for the ears of artillerymen. By a medecin-aide-major of French Artillery regiment.
 10 to 11.30 a. m.----- Wounds of soft parts. By a medecin-major of a French surgical hospital.
 1.15 to 4.30 p. m.----- Gas instruction.
- Feb. 7:
 8.30 to 10 a. m.----- Obturators for the ears of artillerymen.
 10 to 11.30 a. m.----- Lesions of bones and articulation in war. By a medecin-major of a French surgical hospital.
 1.15 to 4.30 p. m.----- Gas instruction.
- Feb. 8:
 10 to 10.50 a. m.----- Fractures in war.
 10.50 a. m. to 12 m.----- Casualty clearing stations.
 1 to 3.30 p. m.----- Map reading (engineer school).
- Feb. 9:
 9 to 10.30 a. m.----- War game (at staff college).
 10.30 to 12 a. m.----- Casualty clearing stations.
 2 to 3 p. m.----- The Medical Department in the trenches.
- Feb. 11:
 9.30 to 10.30 a. m.----- Comparison of medical services.
 10.30 to 11.30 a. m.----- British medical service.
 1 to 3 p. m.----- Field sketching.
- Feb. 12:
 9.30 to 10.30 a. m.----- Regimental surgeon in trench warfare.
 10.30 to 11.30 a. m.----- Line of communications.
 2 to 3 p. m.----- Field hospitals.
 3 to 4 p. m.----- Report of a visit to scabies hospital, corps rest station, motor ambulance convoy, stationary ambulance 29, and General Hospital 70, in the British lines.
- Feb. 13:
 9.30 to 10.30 a. m.----- Line of communications.
 10.50 to 12 a. m.----- Genitourinary surgery and venereal diseases.
 2 to 3 p. m.----- Comparisons of medical services.
 3 to 4 p. m.----- Some medical aspects of the Battle of Cambrai. By an officer who took part in this battle.
- Feb. 14:
 9.30 to 10.30 a. m.----- Ambulance companies.
 10.50 to 12 a. m.----- Genitourinary surgery and venereal diseases.
 2 to 3 p. m.----- Casualty clearing stations and evacuation hospitals.
 3 to 4 p. m.----- Battle of Cambrai.
- Feb. 15:
 9.30 to 10.30 a. m.----- Oral hygiene.
 10.30 to 12 a. m.----- Genitourinary surgery and venereal diseases.
 2 to 3 p. m.----- Pneumonia. By commander of officers' hospital for the Army school area.
 3 to 4 p. m.----- Comparison of medical services.

Feb. 16:

10 a. m.----- Shock.
 1.30 p. m.----- Dugouts. By officer of Engineer Corps.

Feb. 18:

9 to 10.20 a. m.----- Map reading, conference.
 10.30 to 11.30 a. m.----- Hygiene in trenches and rest areas.
 1.30 to 4.30 p. m.----- Map reading, problem.

Feb. 19:

9 to 10.20 a. m.----- Map reading, conference.
 10.30 to 11.30 a. m.----- Standard sanitary devices.
 1.30 to 4.30 p. m.----- Map reading, problem.

Feb. 20:

9 to 10.20 a. m.----- Map reading, conference.
 10.30 to 12 a. m.----- Map reading, problem.
 2 to 4 p. m.----- Demonstrations of French system of physical exercises.

Feb. 21:

9 to 10 a. m.----- Operative treatment of wound shock.
 10.30 to 11.30 a. m.----- Shock.
 1.30 to 4.30 p. m.----- Map reading, problem.

Feb. 22:

Trench fever. Return of class to their stations.

PROGRAM OF THIRD CLASS OF THE ARMY SANITARY SCHOOL

February 25 to March 3, 1918

[First hour, 9 to 10.30 a. m.; second hour, 10.30 to 12 a. m.; third hour, 1.30 to 3 p. m.; fourth hour, 3 to 4.30 p. m.]

FIRST PERIOD

Day	Date	Hour	Subject	Day	Date	Hour	Subject
1	Feb. 25	1	Address by the commandant.	4	Feb. 28	3	Trench sanitation.
		2	Comparison of medical services.			4	Veneral diseases.
		3, 4	Gas instruction.	5	Mar. 1	1	Water supply.
2	Feb. 26	1	Personal hygiene.			2	Food supply, preservation and preparation.
		2	Comparison of medical services.			3	Laundries and baths.
		3, 4	Gas instruction.			4	Diseases of war.
3	Feb. 27	1	Fighting formations.	6	Mar. 2	1	Field lines of information.
		2	Comparison of medical services.			2	Standard sanitary devices.
		3, 4	Gas instruction.			3	Wound shock.
4	Feb. 28	1	Battle of Cambrai.			4	War surgery.
		2	Trenches, dugouts, etc.				

PROGRAM OF THIRD SESSION OF THE ARMY SANITARY SCHOOL

March 4 to 28

TRIP TO BRITISH FRONT

The class left as per the attached order for the school of instruction of the Royal Army Medical Corps, of the First Army, March 4, arriving March 6, 1918.

One of the class, Major Poole, was called to the American front on an operating team the 3d of March and did not accompany the class.

The English had arranged for instructions to be given conjointly with a British class of some 20 medical officers.

The course of this school concluded March 16, and the class left for a course at the base, 13 officers going to one of the largest base ports in the English Army and 14 going to a similar base port elsewhere. The course of these two groups was similar, but the instruction in Group 1 was more extensive. These programs are separately attached under headings program, Group 1, and Group 2, at base.

These groups left their respective base ports on the 21st of March and were again consolidated into a single class to spend five days in the hospitals of Paris, arriving there on the 21st.

FIRST ARMY, R. A. M. C., SCHOOL OF INSTRUCTION

Second American medical officers' course—third class, Army Sanitary School, March 3 to 16, 1918

Time	Wednesday, Mar. 6	Thursday, Mar. 7	Friday, Mar. 8	Saturday, Mar. 9	Sunday, Mar. 10	Monday, Mar. 11
8.30 a. m.		Physical drill	Physical drill	Breakfast		Physical drill
9 a. m.		Breakfast	Breakfast		Breakfast	Breakfast
10 a. m.	Class arrived	Opening address, D. M. S., First Army. General lecture: "Surgery"	Lecture: "Gas poisoning"	Visit to front line in 5 groups		Lecture: "Flies in relation to disease"
11 a. m.		Lecture: "W nephritis"	Visit to sanitary school and demonstration of sanitary appliances	M. D. S.	10.45 a. m. Church parade; assistant chaplain, First French Army	Lecture: "Wound shock"
12 noon		Demonstration: Thomas splint	Lecture: "Obscure diseases of the war"	A. D. S.	Discussion on the duties of a division surgeon	Lecture: "Care of transport (animals and wagons)," director of British school
1 p. m.	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
2 p. m.	Visit to No. 6 casualty clearing station	Visit to scabies station and corps rest station	1.30 p. m. Lecture: "Field sanitation"	R. A. P.		1.30 p. m. Visit to No. 12 stationary hospital and demonstration of results of research and the transmissibility of trench fever by the louse
3 p. m.		Inspection of field ambulance equipment	Lecture: "Surgery of the war and casualty clearing station"	Inspection of dugouts, anti-gas protection, trench, latrines, etc.		
4.30 p. m.	Tea	Tea	Tea	Tea	Tea	Tea
5 p. m.	Talk: Customs of the service. By the commandant	Field ambulances, by the director, British school	Discussion: War surgery	Discussion on trench conditions as per visit	Conference: front-line work	Lecture: "Work at a casualty clearing station"
8 p. m.	Officers' mess	Officers' mess	Officers' mess	Officers' mess	Officers' mess	Officers' mess

*Second American medical officers' course—third class, Army Sanitary School, March 3 to 16
1918—Continued*

Time	Tuesday, Mar. 12	Wednesday, Mar. 13	Thursday, Mar. 14	Friday, Mar. 15	Saturday, Mar. 16
8.30 a. m.	Physical drill	Physical drill	Physical drill	Physical drill	
9.00 a. m.	Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
10 a. m.	Lecture: "Pathology of medical diseases"	10 to 10.30 a. m. Address and practical demonstration given to 100 enlisted of the R. A. M. C., with demonstration of first aid. D. M. S., First Army	Lecture: "Gas gangrene and wound infection"	Lecture: "Duties of regimental medical officers D. M. S., First Army"	Departure after inspection by D. M. S., First Army
11 a. m.	Practical demonstration: Triangular bandage and the use of the rifle splint	10.30 to 11.30 a. m. Lecture: "Evacuation of casualties from front line." By the commanding officer of a litter group, field ambulance	Booking for sick and wounded		
12 noon	Lecture: "Trench fever"	11.30 to 12 noon Practical demonstrations: "Rechauffement." Lecture: "Dug-outs"	Lecture: "Skin diseases"	Lecture: "Gunshot wounds of chest"	
1 p. m.	Lunch	Lunch	Lunch	Lunch	
2 p. m.	Visit to Nos. 1 and 23 casualty cleaning stations	Visit and demonstration School of Cookery	Visit to Nos. 30 and 57, casualty cleaning stations	Résumé. Lecture	
4.30 p. m.	Tea	Tea	Tea	Tea	
5 p. m.	Discussion: Medical officers British Army on wound shock		Conference: Casualty cleaning station methods		
8 p. m.	Officers' mess	Officers' mess	Officers' mess	Officers mess: farewell dinner to General Thompson, his staff, and British medical officers	

PROGRAM AT A BASE PORT, BRITISH ARMY

Group 2, under the command of Lieutenant Colonel Porter

March 16:

Arrived at Etaples; met by representative of C. C. M. S. and taken to a British Expeditionary Force canteen club, where the class was installed in cubicles adjoining the officers' club and dining room.

March 17:

10 a. m. Reported to Colonel Bearford, C. C. M. S. and met Captain Childs, special sanitary officer.

2 p. m. Visit to large camp laundry and ablution huts, and reinforcement Camp E.

March 18:

a. m. Visit to fat reclamation establishment, sanitary section camp and workshops.

p. m. Visit to kitchens of reinforcement camps and latrines of same.

March 19:

a. m. Visit to W. A. A. C. camps. Visit to St. Johns Ambulance Brigade Hospital.

p. m. Visit to No. 51, General Hospital (venereal), and No. 15, General Hospital.

March 20:

- a. m. Visit to observation surgical wards (experimental). Visit to Canadian General Hospital No. 1, femur wards.
p. m. Visit to hospital ambulance ships, Bologne; convalescent camp.

March 21:

Return to Paris.

March 22:

- 9 a. m. At the Hospital Beaujon; lecture on "Surgery of the Chest," followed by operative clinic, and demonstration of the organization of the French Medical Service in War.
2 p. m. Visit to the Val-de-Grace Museum.

March 23:

- 7 a. m. to 6 p. m. Visit fracture hospital, French Army, V. R. 76.
(a) Bedside clinic and demonstration of cases and appliances.
(b) Lecture on war surgery, and organization of the Medical Service of the French Army.
(c) The débridement of war wounds.
(d) Transfusion of blood.
(e) Wilhelm's treatment of joint injuries.
(f) Lecture and demonstration of apparatus and a lantern exposition, by a radiologist of the hospital.

March 24:

Visit and demonstration of cases at St. Nicolas Hospital for the burned; ambrine treatment and the injection of refined guaiacol with oil for the diminution of scar tissue.

March 25:

- 9 a. m. Demonstration of dressing by Carrel-Dakin method in the Hospital Lycée Buffon.
4 p. m. Clinic lecture with demonstration of cases and methods of diagnosis at Professor Babinski's Clinic at Lycée Buffon, subject: "The diagnosis of obscure nerves of the diseases and injuries of the nervous system in war."

March 26:

- 8 a. m. Special operative clinic on war surgery at the Lycée Buffon; p. m., visits to the various hospitals in Paris.

March 27:

- 8.15 a. m. Lecture by Professor Morestin, military hospital at Val-de-Grace on cranio-plasty in wounds of war; followed by operative clinic at which the following operations were performed:
(1) Rhinoplasty.
(2) Cancer of the tongue with a complete removal of glands surrounding vessels of the neck, the external dissection of the tonsils and part of the palatine arch, by Professor Morestin.

March 28:

En route from Paris to the Army Sanitary School.

Day	Date	Hour		Day	Date	Hour	
SECOND PERIOD				THIRD PERIOD—continued			
7	Mar. 4	-----	Leave for front.	35	Apr. 2	2	Duties of division and corps surgeons.
8	Mar. 5	-----	Arrive at front.			3	Field messages.
26	Mar. 23	-----	Arrive at Paris.			4	Venereal diseases.
31	Mar. 28	-----	Arrive at Langres.	36	Apr. 3	1	Lines of communications.
THIRD PERIOD						2	War neuroses.
32	Mar. 29	1	Regimental surgeon in trench warfare.			3	Battle casualties and evacuation.
		2	Equipment of Medical Department soldier.	37	Apr. 4	4	Battle of Cambrai.
		3	Lines of communications.			1, 2	Map reading conference.
		4	Classification and disposal of casualties.	38	Apr. 5	3, 4	Map problem.
33	Mar. 30	1	The ambulance company.	39	Apr. 6	1, 2	Map reading conference.
		2	Evacuation hospitals.			3, 4	Map problem.
		3	Pneumonia.	40	Apr. 8	1, 2	War surgery.
34	Apr. 1	1	Trench fever and icterus.			3, 4	Field work with ambulance company.
		2	Oral hygiene.	41	Apr. 9	1, 2	War surgery.
		3	Field hospitals.			3, 4	Ambulance company training and demonstration.
35	Apr. 2	1	Scabies hospital, motor ambulance convoys, stationary hospital, Red Cross depots.	42	Apr. 10	-----	Return to proper stations.

As noted in the following communication, beginning with the fourth course the policy of the school was changed with respect to the length of the course and the number of students attending. These changes were in line with the following communication from general headquarters, A. E. F., to the commandant, Army schools:⁸

GENERAL HEADQUARTERS,
AMERICAN EXPEDITIONARY FORCES,
France, March 4, 1918.

From: The Adjutant General.

To: The commandant, Army schools.

Subject: Army Sanitary School.

1. In order to secure economy, efficiency, and systematized training of officers of the Medical Department, it is desired to consolidate all school instruction of medical officers at the Army Sanitary School; and for the purpose of securing a greater flow of students through this school, to increase the classes to at least 50 medical officers and to shorten the length of the period of general instruction to one month at the Army Sanitary School. But it is still desired to send 25 students of each class who have shown the greatest aptitude in their work to some sector of the allied front on a visit of instruction of two weeks duration where they may receive special training in order to render them available for duty as instructors in the corps and division.

2. Instruction of medical officers as outlined should begin with the fourth class, which will be ordered to report to the Army school about April 7, 1918, and should follow as closely as practicable the inclosed schedule, particular attention being given to instruction by map problems and terrain exercises. It is desired that such arrangements as may be necessary be made for future classes upon this basis.

3. In view of the necessity for instruction of dental officers in order to prepare them for duty with troops; the inadvisability of establishing a new dental school in Paris and elsewhere; and the economy in teaching force, equipment, and housing of the dental school, established as it now is as a section of the Army Sanitary School, it is deemed best that it continue at Langres.

By command of General PERSHING:

F. R. KINNEY, *Adjutant General.*

PROGRAM OF INSTRUCTION, ARMY SANITARY SCHOOL—ONE MONTH

1. Administration:	Hours
General orders and circulars, American Expeditionary Forces; bulletins and circulars, chief surgeon, A. E. F.; field records of sick and wounded; property and individual accounts.....	4
2. Military sanitation:	
Personal hygiene, venereal prophylaxis, care of feet.....	2
General hygiene—march, camp, trench, combat, disposal of the dead.....	4
Water—supply, examination, treatment.....	1
Food—supply, preservation, preparation.....	1
Clothing—supply, cleansing.....	1
Laundries—devices, methods.....	1
Bathing—devices, methods, delousing, insecticides.....	2
Shelter—selection, improvisation, construction of huts, barracks, billets, and their sanitary inspection.....	1
Disposal of wastes—human, animal, kitchen, and camp garbage.....	2
Standard sanitary devices—demonstration and description of use.....	2
3. Military surgery:	
Sepsis, antisepsis, shock—special wounds, special methods of treatment.....	10
4. Military medicine:	
Psychology, psychiatry, malingering, special diseases, including treatment of gas poisoning.....	10

	Hours
5. General instruction:	
Organization of the expeditionary forces.....	1
Disposition of combatant and auxiliary troops—march, attack, defense, retirement, trench.....	4
Field orders.....	1
Field sketching.....	16
Artillery and infantry weapons—effects.....	1
Fire cover—use and construction, trenches, dugouts, bombproofs, drainage, and ventilation.....	4
Field transportation—use and care of animals, their equipment, wagons, and motors.....	8
Gas defense—agents used, wind, alarms, methods, and devices for protection and removal; gas drill.....	18
6. Military tactics:	
Sanitary units—equipment and functions.....	4
Casualties—classification and disposal.....	2
Field duties—of unit commanders, directors, surgeons.....	2
Problems—map and terrain exercises, battalion, regiment, brigade, division in attack, defense, retirement.....	54

7. Visit of instruction: At the close of each course 25 officers of each class showing the greatest aptitude will be conducted on a visit of instruction of two weeks' duration to some sector of the allied front where they will be given special opportunities for observation and training.

The instruction will consist of demonstrations and problems for the purpose of training officers in handling sanitary units and the evacuation of casualties of field service. Instruction in hygiene, sanitation, administration, and medicine and surgery will be limited to preparation for the mastery of problems presented by service conditions to be encountered by the expeditionary forces. The time to be given to the various subjects as laid down in program is merely advisory, except in regard to sanitary tactics to which full time will be given.

After the fourth session of the school the tours for instruction were made principally to the American sector and written reports were not made by the officers conducting these tours.

PROGRAM, ARMY SANITARY SCHOOL

FIFTH SESSION (OFFICERS)

Daily, except Sundays and holidays, 6.15 to 7 a. m., drill and setting-up exercises.

First period, 9 to 10.30 a. m.; second period, 10.30 a. m. to 12 m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Sunday, May 26:

9 a. m. Opening address.

Monday, May 27 (first day):

1. Map reading.
2. Field sketching.
3. Histopathology and bacteriology of war wounds.
4. Bathing, delousing, and laundrying.

Tuesday, May 28 (second day):

1. Field orders.
2. Application and demonstration of Thomas and other splints.
3. { Dugouts and their camouflage.
4. {

Wednesday, May 29 (third day):

1. The Army kitchen.
2. Primary, primary delayed, and secondary sutures.
3. Regimental and battalion aid stations in this war.
4. The ambulance company and its dressing station and the field hospital.

Friday, May 31 (fourth day):

1. The evacuation hospital.
2. Principles of war surgery.
3. Malingering.
4. War-wound infection and abdominal injuries.

Saturday, June 1 (fifth day):

1. Obscure medical diseases of war.
2. Shock.
3. Skin diseases and scabies.
4. Venereal diseases.

Monday, June 3 (sixth day):

1. Disorderly action of the heart.
2. Principles and early treatment of bone and joint injuries.
3. Organization and general activities of the section of orthopedic surgery.
4. Convalescent camps.

Tuesday, June 4 (seventh day):

1. }
2. } Visit to central laboratory.
3. }
4. }

Wednesday, June 5 (eighth day):

1. }
2. } Visit to evacuation hospital.
3. }
4. }

Thursday, June 6 (ninth day):

1. }
2. } Gas instruction (beginning at 8.30
3. } a. m.).
4. }

Friday, June 7 (tenth day):

1. }
2. } Visit to medical-supply depot.
3. }
4. }

Saturday, June 8 (eleventh day):

1. }
2. } Gas instruction (beginning at 8.30
3. } a. m.).
4. }

Monday, June 10 (twelfth day):

1. } Visit to front.
2. }
3. } Lecture by Major Allison at Evacuation Hospital No. 2: "Orthopedic work in the tactical division."
4. }

Tuesday, June 11 (thirteenth day):

1. }
2. } Visit to front.
3. }
4. }

Wednesday, June 12 (fourteenth day):

1. }
2. } Visit to front.
3. }
4. }

Thursday, June 13 (fifteenth day):

1. }
2. } Map and terrain exercise.
3. }
4. }

Friday, June 14 (sixteenth day):

1. Sanitation in this war, including disposal of wastes on the march, in camp, and in combat.
2. War nephritis.
3. Physiological treatment of gassed cases.
4. Function of the physician in the American Expeditionary Forces.

Saturday, June 15 (seventeenth day):

1. Personal and general hygiene.
2. Oral hygiene.
3. }
4. } Field sketching exercises.

Monday, June 17 (eighteenth day):

1. }
2. } Cars: use and repair of motor vehicles
3. }
4. } Field sketching exercises.

Tuesday, June 18 (nineteenth day):

1. Trench fever.
2. Wounds of the soft parts.
3. Symptoms and treatment of war neuroses and shell shock.
4. The mental side of military delinquency.

Wednesday, June 19 (twentieth day):

1. Disposition of combatant and auxiliary troops on the march and in intrenched positions.
2. The effects of new ordnance in this war.
3. War neuroses.
4. Austrian and German medical services.

Thursday, June 20 (twenty-first day):

1. Austrian and German medical services.
2. Neurological problems in a general hospital.
3. Maxillofacial injuries (1 to 2 p. m.).
4. Ophthalmology (2 to 3 p. m.).
5. Surgery of the ear, nose, and throat (3 to 4 p. m.).

Friday, June 21 (twenty-second day), to Monday, June 24 (twenty-fourth day), inclusive:

Trip to the front.

Tuesday, June 25 (twenty-fifth day):

1. Tetanus and gas gangrene.
2. Bone and joint injuries.
3. Shock.
4. War neuroses.

8 p. m., surgery of the nervous system.

Wednesday, June 26 (twenty-sixth day):

1. } Food, its conservation, inspection and
2. } the handling of the ration; exhibition
3. } of kitchens and other appliances in
4. } the school area.
3. Examination of water, and its treatment.
4. The duties of a division and corps surgeon.

CANDIDATES FOR COMMISSION IN MEDICAL RESERVE CORPS ^b

Daily, 6.15 to 7 a. m., drill and setting-up exercises.

First period, 9 to 10.30 a. m.; second period, 10.30 a. m. to 12 m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Tuesday, May 21 (first day):

1. }
2. }
3. } Gas instruction.
4. }

Wednesday, May 22 (second day):

1. }
2. }
3. } Gas instruction.
4. }

Thursday, May 23 (third day):

1. Battalion aid stations and duties of regimental medical officers.
2. The ambulance company and its stations.
3. The field hospital in this war.
4. The evacuation hospital.

Friday, May 24 (fourth day):

1. Map reading.
2. Field sketching, lecture.
3. Field orders.
4. Sanitation in this war.

Saturday, May 25 (fifth day):

1. Map and terrain exercises.
2. Sanitation in this war.
3. }
4. } Map and terrain exercises.

Monday May 27 (sixth day):

1. } Medical Department organization,
2. } records, and office work.
3. Histopathology and bacteriology of war wounds.
4. Bathing, delousing, and laundering.

Tuesday, May 28 (seventh day):

1. } Medical Department organization,
2. } records and office work.
3. } Demonstration of dugouts, trenches,
4. } bombproofs, and their camouflage.

Wednesday, May 29 (eighth day):

1. The Army kitchen.
2. Primary, primary delayed, and secondary suture.
3. }
4. } Practical field sketching.

Thursday, May 30 (ninth day):

Memorial Day.

Friday, May 31 (tenth day):

1. } Medical Department organization,
2. } records, and office work.
3. Malingering.
4. War-wound infection and abdominal injuries.

Saturday, June 1 (eleventh day):

1. Obscure medical diseases of war (a review).
2. Shock.
3. Skin diseases and scabies in this war.
4. Venereal diseases.

Monday, June 3 (twelfth day):

1. Disorderly action of the heart (D. A. H.).
2. Principles and early treatment of bone and joint injuries.
3. Notes on stationary, general, and base hospitals, scabies hospitals, rest stations, and other Medical Department organizations of the allied armies.
4. Convalescent camps.

Tuesday, June 4 (thirteenth day):

1. }
2. } Visit to central laboratory (canceled
3. } for lack of transportation).
4. }

Wednesday, June 5 (fourteenth day):

1. }
2. } Visit to Evacuation Hospital No. 1
3. } (canceled for lack of transportation).
4. }

Thursday, June 6 (fifteenth day):

1. }
2. }
3. } Map and terrain exercises.
4. }

Friday, June 7 (sixteenth day):

1. }
2. } Visit to a medical-supply depot (canceled for lack of transportation).
3. }
4. }

^b This class was composed of 30 medical students ordered to the school from Base Hospital No. 18 in compliance with S. O. No. 137, G. H. Q. A. E. F., France, May 17, 1918.

SIXTH SESSION (SECTION I)

Daily, except Sundays and holidays 6.45 to 7.15 a. m., setting-up exercises.

First period, 9 to 10.30 a. m.; second period, 10.30 to 12 a. m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Tuesday, July 2:

1. Opening address.
2. Map reading.
3. Histopathology and bacteriology of war wounds.
4. Bathing, delousing, and laundering.

Wednesday, July 3:

1. Field orders.
2. Application and demonstration of Thomas and other splints.
3. } Dugouts and their camouflage.
4. }

Friday, July 5:

1. }
2. } Gas instruction (beginning at 8.30 a. m.).
3. }
4. }

Saturday, July 6:

1. }
2. } Gas instruction (beginning at 8.30 a. m.).
3. }
4. }

Monday, July 8:

1. The Army kitchen.
2. Primary, primary delayed, and secondary suture.
3. Regimental and battalion aid stations in this war.
4. The ambulance company and its dressing station, and the field hospital.

Tuesday, July 9:

1. } Food; its conservation, inspection; and the handling of the ration.
2. } Exhibition of kitchens and other appliances in the school area.
3. The duties of a division and corps surgeon.
4. The evacuation of the wounded in the 1st Division.

Wednesday, July 10:

1. }
2. } Visit to central medical laboratory.
3. }
4. }

Thursday, July 11:

1. The evacuation hospital.
2. Neurological problems in a general hospital.
3. Surgery in a combat division.
4. Map reading.

Friday, July 12:

1. Map and terrain exercises.
2. Organization and general activities of the section of orthopedic surgery.
3. Map and terrain exercises.
4. Principles of war surgery.
5. (4 p. m.). Demonstration of injection of novarsenobenzol.

Saturday, July 13:

1. } Neurological clinics at Base Hospital
2. } No. 117, and inspection of hospital
3. } train (leaving school in ambulances
4. } at 8.30 a. m.).

Sunday, July 14:

2. Shock.

Monday, July 15:

1. Personal and general hygiene.
2. Wounds of soft parts.
3. Physiological treatment of gassed cases.
4. Convalescent camps.

Tuesday, July 16:

1. Sanitation.
2. Otolaryngology.
3. Ophthalmology.
4. Field sketching.

Wednesday, July 17:

1. Principles and early treatment of bone and joint.
2. Injuries.
3. Trench fever.
4. Demonstration of splinting and heating apparatus.

Thursday, July 18:

1. } Field sketching exercise.
2. }
3. Venereal diseases.
4. Skin diseases.

Friday, July 19:

1. The disposition of combatant and auxiliary troops on the march and in intrenched positions.
2. Malingering.
3. War-wound infections and abdominal injuries.
4. Field sketching.

Saturday, July 20:

1. The disposition of combatant and auxiliary troops on the march and in intrenched positions.
2. Internal medicine in the Army.
3. Disordered actions of the heart.
4. Field sketching.

Monday, July 22:

1. The effects of the commonly used gases.
2. Sanitation.
3. Sanitary tactics.
4. The physiology of respiration.

Tuesday, July 23:

1. The causes of gas casualties.
2. The battalion surgeon.
3. } Departure for American front at
4. } 4.45 p. m.

Wednesday, July 24:

Arrival at American front.

Thursday, July 25 (at American front):

- 9.10 a. m.----- Lecture by division surgeon on "General description of sector."
 10 a. m. to 6 p. m.--- Class divided into four groups to visit regimental and battalion aid stations and observe trench conditions (one group to each regiment under regimental surgeon).

Friday, July 26 (at American front):

- 8 to 9 a. m.----- Lecture by commanding officer, sanitary train, on "Workings of ambulance companies and field hospitals."
 9 a. m. to 6 p. m.--- Group A to visit ambulance dressing stations, delousing stations, and field hospitals, operating as triages (F. H. 326 and 328) under the director, ambulance companies.
 Group B to visit immobilized field hospitals, caring for division sick (F. H. 325 and 327), and Evacuation Hospital No. 1 and Mobile Hospital No. 39.

Saturday, July 27 (at American front):

- 8 to 9 a. m.----- Lecture by commanding officer, Evacuation Hospital No. 1, on "Evacuation of wounded to the rear."
 9 a. m. to 6 p. m.--- Group A to visit immobilized field hospitals, caring for division sick (F. H. 325 and 327), and Evacuation Hospital No. 1, and Mobile Hospital No. 39.
 Group B to visit ambulance dressing stations, delousing stations, and field hospitals operating as triages (F. H. 326 and 328) under the director, ambulance companies.
 8 p. m. to 2 a. m.--- Class divided into four groups to visit regimental and battalion aid stations and observe trench conditions; one group to each regiment under the regimental surgeon. Groups to visit different regiments from those visited first day.

Sunday, July 28:

Return to school.

Monday, July 29:

1. Oral hygiene.
2. Chest surgery.
3. Maxillofacial injuries.
4. Field sketching.

Tuesday, July 30:

1. }
2. } Map and terrain exercises.
3. }
4. }

Wednesday, July 31, to Monday, August 5, inclusive:

Tour of instruction to Paris and vicinity.

Return to proper stations.

SIXTH SESSION (SECTION 11)

Daily, except Sundays and holidays, 6.45 to 7.15 a. m., drill and setting-up exercises.

First period, 9 to 10.30 a. m.; second period, 10.30 a. m. to 12 m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Tuesday, July 16, 1918:

1. Sanitation.
2. Otolaryngology.
3. Ophthalmology.
4. Field sketching.

Wednesday, July 17:

1. } Principles and early treatment of
2. } bone and joint injuries.
3. Trench fever.
4. Demonstration of splinting and heating apparatus.

Thursday, July 18:

1. Field sketching exercises.
2. Venereal diseases.
3. Skin diseases.

Friday, July 19:

1. The disposition of combatant and auxiliary troops on the march and in intrenched positions.
2. The ambulance company.
3. War-wound infections and abdominal injuries.
4. Field sketching.

Saturday, July 20:

1. The disposition of combatant and auxiliary troops on the march and in intrenched positions.
2. Internal medicine in the Army.
3. Disordered action of the heart.
4. Field sketching.

Monday, July 22:

1. }
2. } Gas instruction (beginning at 8.30
3. } a. m.).
4. }

Tuesday, July 23:

1. }
2. } Gas instruction (beginning at 8.30
3. } a. m.).
4. }

Wednesday, July 24:

1. The physiology of respiration as a basis for the treatment of gassed cases.
2. Wastage and replacements.
3. The ambulance company.
4. The battalion surgeon.

Thursday, July 25:

1. The pathology and treatment of gassed cases.
2. The evacuation of wounded in 1st Division.
3. Routine treatment of syphilis.
4. Shock.
- 3.45 p. m., demonstration of the injection of novarsenobenzol.

Friday, July 26:

1. Causes of gas casualties.
2. Some impressions on front-line work.
3. }
4. } Map problem.

Saturday, July 27:

1. Ordnance.
2. Obscure diseases on the war.
3. War nephritis.
4. Map problem.

Monday, July 29:

1. Oral hygiene.
2. Chest surgery.
3. Maxillofacial injuries.
4. Field sketching.

Tuesday, July 30:

1. }
 2. }
 3. }
 4. }
- Map and terrain exercises.

Wednesday, July 31, to Sunday, August 4, inclusive:

Trip to front.

Monday, August 5:

1. Field orders.
2. Histopathology and bacteriology of war wounds.
3. Bathing, delousing, and laundering.
4. Map reading.

Tuesday, August 6:

1. Convalescent camps.
 2. Food conservation.
 3. }
 4. }
- Demonstration at gas school.

Wednesday, August 7:

1. }
 2. }
 3. }
 4. }
- Visit to central medical laboratory.

Thursday, August 8:

1. Primary, primary delayed, and secondary suture.
2. Duties of a regimental and battalion surgeon.
3. The field hospital.
4. Regimental and battalion aid stations in this war.

Friday, August 9:

1. Surgery in a combat division.
2. Organization and general activities of the section of orthopedic surgery.
3. Thomas splint drill, etc.
4. Map reading.

Saturday, August 10:

1. Tetanus and gas gangrene.
2. The evacuation hospital.
3. Neurological problems in a base hospital.
4. Map and terrain exercises.

Monday, August 12:

1. } Neurological clinics at Base Hospital
2. } 117.
3. }
4. }

Tuesday, August 13:

1. Personal and general hygiene.
2. Wounds of the soft parts.
3. Physiological treatment of gassed cases.
4. Conference on course.

Wednesday, August 14:

- Departure for stations.

SEVENTH SESSION

Daily, except Sundays and holidays, 7.20 a. m., setting-up exercises.

First period, 9 to 10.30 a. m.; second period, 10.30 a. m. to 12 m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Wednesday, August 21:

1. Opening address.
2. Organization of the American Expeditionary Forces.
3. Mental hygiene.
4. The physiological and pathological effects of toxic gases.

Thursday, August 22:

1. } General gas instruction (beginning
2. } at 8.30 a. m.).
3. }
4. }

Friday, August 23:

1. } General gas instruction (beginning
2. } at 8.30 a. m.).
3. }
4. }

Saturday, August 24:

1. Disposition of auxiliary troops on the march and in combat.
2. The treatment of effects produced by suffocating gases.
3. The treatment of effects produced by vesicant gases.
4. Evacuation of wounded in a war of movement; experiences in the 1st Division.

Sunday, August 25:

1 p. m.

Symposium on the work of the 26th Division, American Expeditionary Forces, in the last Battle of the Marne.

Monday, August 26:

1. Disposition of auxiliary and combat troops on the march and in combat.
2. Military hygiene.
3. General personal hygiene.
4. Map and terrain exercises.

Tuesday, August 27:

1. Military hygiene.
2. Artillery and Infantry weapons.
3. Map and terrain exercises.
4. Causes of gas casualties.

Wednesday, August 28:

1. } Map and terrain exercises.
2. }
3. Baths, disinfection, and field laundries.
4. The regimental and battalion surgeon in a war of movement.

Thursday, August 29:

1. Reserve and front-line sanitation.
2. Fire cover, dugouts, camouflage, etc.
3. } Demonstration of Infantry and Medical Department; dugouts, camouflage, and gas offensive and defensive.
4. }

Friday, August 30:

1. Sanitation in billeting areas and troop movements.
2. Evacuation of wounded.
3. } Sanitary devices in the school area.
4. }

Saturday, August 31:

1. Ambulance company.
2. The regimental and battalion surgeon; and the battalion aid station in trench warfare.
3. Field sketching.
4. The 4th Division in the second Battle of the Marne.

Sunday, September 1:

- 10.30 a. m. Early treatment of head and chest cases.

Monday, September 2:

1. Histopathology of war wounds.
2. The American Red Cross.
3. Internal medicine in the Army.
4. Consideration of the heart under war conditions; the effort syndrome.

Tuesday, September 3:

1. Bacteriology of war wounds.
2. The use of gum solutions in shock.
3. Field orders.
4. Wastage and replacements.

Wednesday, September 4:

1. Primary and primary delayed suture.
2. The Thomas splint drill and splinting in general.
3. Shock.
4. General considerations in the wounds of war.

Thursday, September 5:

1. General considerations in the wounds of war.
2. Field duties of division and corps surgeon.
3. Organization and general activities of the section of orthopedic surgery.
4. Field orders.

Friday, September 6:

1. } Field sketching.
2. }
3. Practical resuscitation of wounded suffering from shock.
4. Blood transfusion.

Saturday, September 7:

1. Field transportation.
2. The Army kitchen and the feeding of men; conservation of food.
3. Conference on map problem.
4. Nature and early treatment of bone and joint injuries.

Monday, September 9:

1. } Field sketching.
2. }
3. Roentgenology in this war.
4. Neurological problems in Army hospitals.

Tuesday, September 10:

1. } Map and terrain exercises.
2. }
3. The intervention of the military surgeon in ophthalmological cases.
4. Maxillofacial injuries.

Wednesday, September 11:

1. }
2. } Neurological clinic at Base Hospital
3. } 117.
4. }

Thursday, September 12:

1. } Map and terrain exercises.
2. }
3. } The field hospital.
4. }

Friday, September 13:

1. } Map and terrain exercises.
2. }
3. } Evacuation hospital.
4. }

Saturday, September 14:

1. } Map and terrain exercises.
2. }
3. The prevention and treatment of venereal disease in the American Expeditionary Forces.
4. Skin diseases.

Monday, September 16:

1. Tetanus and gas gangrene.
2. Abdominal wounds.
3. The division of laboratories in the American Expeditionary Forces.
4. General orders, bulletins, and circulars, American Expeditionary Forces.

Tuesday, September 17:

1. } Map problems.
2. }
3. Convalescent camps.
4. Gas instruction.

Wednesday, September 18:

1. }
2. } Map problems.
3. }
4. }

Thursday, September 19:

- Departure for front.

EIGHTH SESSION

Daily, except Sundays and holidays, 7.20 a. m., setting-up exercises.

Daily, 7.45 a. m., breakfast.

(NOTE.—The numbers after the titles refer to articles in the mimeographed literature of the school which should be studied the day previous. When there are many numbers and time is limited, use index in making selection.)

First period, 9 to 10.30 a. m.; second period, 10.30 a. m. to 12 m.; third period, 1.30 to 3 p. m.; fourth period, 3 to 4.30 p. m.

Wednesday, October 16:

1. Opening remarks.
2. Organization of the American Expeditionary Forces (141).
3. Organization of the surgical services in the American Expeditionary Forces.
4. Mental hygiene (40, 52).

Thursday, October 17:

1. Tactics (151).
2. Artillery and infantry weapons.
3. The field hospital and ambulance company (135, 54, 73, 76, 91).
4. Map reading; lecture.

Friday, October 18:

1. Disposition of combat and auxiliary troops on the march and in combat.
2. Map reading; lecture.
3. Histopathology of war wounds (55, 119).
4. General personal hygiene (4, 5, 7, 34, 116, 118, 130); 8.30 p. m. Shock (46, 109, 115).

First period, 8.30 to 9.30 a. m.; second period, 9.40 to 10.40 a. m.; third period, 10.50 to 11.50 a. m.; fourth period, 1.30 to 2.30 p. m.; fifth period, 2.40 to 3.40 p. m.; sixth period, 3.50 to 4.50 p. m.

Wednesday, October 23:

1. Evacuation of wounded (1, 2, 11, 20, 27, 50, 64, 92, 120, 138).
2. Regimental and battalion surgeon, and the battalion aid station in trench warfare (9, 13, 14, 18, 19, 100, 102, 103, 104, 120, 143).
3. Evacuation of wounded (1, 2, 11, 20, 27, 50, 64, 92, 120, 138).
4. } Field duties of division and corps
5. } surgeons (138, 60).
6. }

Thursday, October 24:

1. }
2. }
3. } Map problems.
4. }
5. }
6. }

Saturday, October 19:

1. Disposition of combat and auxiliary troops on the march and in combat.
2. Organization of the Medical Department in the American Expeditionary Forces.
3. Map problem.

Monday, October 21:

1. }
2. } Instruction in gas defense (begin-
3. } ning at 8:30 a. m.).
4. }

Tuesday, October 22:

1. }
2. } Instruction in gas defense (begin-
3. } ning at 8.30 a. m.).
4. }

Friday, October 25.

1. The Army kitchen and the feeding of men; conservation of food (42, 51, 135).
2. Sanitation in billeting areas and during troop movements (25, 26, 55, 58, 126, 129).
3. Surgical experiences in the present offensive.
4. }
5. } Map problems.
6. }

Saturday, October 26:

1. The regimental and battalion surgeon in a war of movement (12, 68, 100, 120, 143).
2. Field transportation.
3. Fire, cover; dugouts, camouflage, etc. (41).
4. Demonstration of Infantry and Medical Department dugouts, camouflage, etc. (41).
5. }
6. }

Monday, October 28:

1. Baths, disinfestation, and field laundries (37, 118).
2. Office work.
3. Field sketching; lecture.
4. }
5. } Map problem.
6. }

Tuesday, October 29:

1. Evacuation of wounded in a war of movement. Experiences in the 1st Division (27, 92, 138).
2. Phosgene.
3. Division of laboratories in the American Expeditionary Forces.
1 p. m. Hemorrhage and shock and the treatment of their conditions.
4. }
5. } Sanitary devices in the school area.

Wednesday, October 30:

1. }
2. }
3. }
4. } Map problem.
5. }
6. }

Thursday, October 31:

1. Duties of the evacuation officer of an army.
2. The American Red Cross.
3. } Physiologic treatment of gassed cases
4. } (Cir. Letter No. 34, C. S. O.).
5. Acute infections of the respiratory tract.
6. The prevention and treatment of venereal diseases in the American Expeditionary Forces (7, 8, 16, 125).
- 7.30 p. m. Venereal diseases; skin diseases (31, 39, 56, 107, 108, 134).

Friday, November 1:

1. Discussion.
2. Thomas splint drill and splinting in general (10, 45, 68, 85).
3. The nature and early treatment of bone and joint injuries (81, 93, 94, 95, 96, 131).
4. } General considerations in the wounds
5. } of war (33, 43, 74, 131, 137).

Saturday, November 2:

- Class divided into two sections.
Section I left for two weeks' tour of instruction to front.
Section II left for the central Medical Department laboratory at Dijon for a 3-day course in methods of treatment of shock and hemorrhage.

NINTH SESSION

Daily, 7.45 a. m., breakfast.

(NOTE.—The numbers after the titles refer to articles in the mimeographed literature of the school which should be studied the day previous. When there are many numbers and the time is limited, use index in making selections.)

First period, 8.30 to 9.30 a. m.; second period, 9.40 to 10.40 a. m.; third period, 10.50 to 11.50 a. m.; fourth period, 1.30 to 2.30 p. m.; fifth period, 2.40 to 3.40 p. m.; sixth period, 3.50 to 4.50 p. m.

Saturday, November 2:

Clinic at Base Hospital No. 53.

Monday, November 4:

Departure for central Medical Department laboratory.

Tuesday, November 5:

Course in shock and hemorrhage and the treatment of these conditions, at central Medical Department laboratory.

Wednesday, November 6:

Course in shock and hemorrhage and the treatment of these conditions, at central Medical Department laboratory.

Thursday, November 7:

Return to Army Sanitary School.

Friday, November 8:

Lecture, demonstration, and drill in the use of the Thomas splint and other splints.

Saturday, November 9:

The treatment of venereal cases, clinic.

Monday, November 11:

1. The Army kitchen and the feeding of men: Conservation of food (42, 51, 135).
2. Mental hygiene (40, 52).
3. Evacuation of wounded (1, 2, 11, 20, 27, 50, 64, 92, 120, 138).
4. The field hospital and ambulance company (135, 54, 73, 76, 91).
5. The regimental and battalion surgeon and the battalion aid station in trench warfare (9, 13, 14, 18, 19, 100, 102, 103, 104, 120, 143).
6. Duties of the evacuation officer of an army.

Tuesday, November 12:

1. The regimental and battalion surgeon in a war of movement (12, 63, 100, 120, 143).
2. General personal hygiene (4, 5, 7, 34, 116, 118, 130).
3. Map reading.
4. Sanitation in billeting areas and during troop movements (25, 26, 55, 58, 126, 129).
5. Medical supplies.
6. Medical supplies.

Wednesday, November 13:

1. Evacuation of wounded in a war of movement; experience in the 1st Division (27, 92, 138).
2. Reserve and front-line sanitation (25, 26, 34, 80).
3. Map reading; lecture.
4. Baths, disinfestation, and field laundries (37, 118).
5. General orders, bulletins, and circulars, American Expeditionary Forces.
6. Map reading; lecture.

Thursday, November 14:

1. }
2. }
3. }
4. } General gas instruction (beginning at 8.30 a. m.); gas school.
5. }
6. }

Friday, November 15:

1. } Demonstration of sanitary appliances in the school area; sanitary squads (25, 55,
2. } 58, 126).
3. } Sanitary devices in the school area (25).
4. }
5. } Map problem; a move by rail.
6. }

Saturday, November 16:

Map problems; conference; defense schemes.

Monday, November 18:

Map problem; conference; a raid.

Tuesday, November 19:

Map problem; conference; preparation for attack.

Wednesday, November 20:

Map problem; conference; road block; liaison.

Thursday, November 21:

Return to proper stations.

TENTH SESSION

(NOTE.—The numbers after the titles refer to articles in the mimeographed literature of the school which should be studied the day previous. When there are many numbers and time is limited, use index in making selection.)

First period, 8.30 to 9.30 a. m.; second period, 9.40 to 10.40 a. m.; third period, 10.50 to 11.50 a. m.; fourth period, 1.30 to 2.30 p. m.; fifth period, 2.40 to 3.40 p. m.; sixth period, 3.50 to 4.50 p. m.

Thursday, November 21:

1. Opening address.
2. Tactics (151).
3. Evacuation of wounded (64,92).
- 1.30 to 3 p. m. The ambulance company and the field hospital (13, 14, 18, 19, 73, 76, 91, 102, 103, 104, 110, 145).
- 3 to 4.30 p. m. Organization of the American Expeditionary Forces (141b).

Friday, November 22:

1. The medical problem of regiments and battalions (25, 26, 55, 58, 126, 129).
2. Map reading; lecture.
3. The prevention of venereal diseases (7, 8, 16, 125).
4. The treatment of venereal diseases (31, 39, 56, 107, 108, 134).
5. Neurological problems in army hospitals.
6. War neuroses (pamphlet in library).

Saturday, November 23:

1.)
2.)
3.) General gas instruction.
4.)
5.)
6.)

Monday, November 25:

1. Area sanitation (25, 26, 55, 58, 126).
2. Disposition of combat and auxiliary troops on the march and in combat.
3. Sanitary tactics (151, 153).
4. Map reading; lecture.
5. The regimental surgeon.
6. The functions of the director of ambulance companies.

Tuesday, November 26:

1. Map reading; lecture.
2. Disposition of combat and auxiliary troops on the march and in combat.
3. The treatment of effects produced by mustard gas (72, 132, 139, 140, 147).
- 1.30 to 3 p. m. Shock and hemorrhage and the treatment of these conditions (106).
- 3 to 4.30 p. m. Shock and hemorrhage and the treatment of these conditions (106).

Wednesday, November 27:

1. The treatment of effects produced by phosgene (72, 132, 147).
2. Field transportation.
3. The division psychiatrist.
4. The division orthopedist.
5. The division medical supply officer.
6. { Skin diseases.
- Venereal diseases.

Thursday, November 28:

Thanksgiving Day.

Friday, November 29:

1. The care of wounded in advance areas.
2. Investigation and treatment of shock (46, 115).
3. Chest wounds (44).
4. Chest wounds (44).
5. Sanitation in corps areas (25, 26, 55, 58, 126).
6. Consideration of the heart under war conditions; the effort syndrome (136).
7. Convalescent camps (23, 122, 128, 149).

Saturday, November 30:

1. General orders, bulletins, etc., American Expeditionary Forces (141b, 150, 152).
2. Artillery and Infantry weapons (117).
3. Skin diseases in the American Expeditionary Forces.
4. The mobile hospital.

Monday, December 2:

1. Medical supplies.
2. The division urologist.
3. The duties of the evacuation officer of an army.
4. }
5. } The organization and general activities of the division of orthopedic surgery.
6. }

Tuesday, December 3:

1. }
2. } Problem; billeting and moving.
3. }
4. The intervention of the military surgeon in otolaryngological cases (127).
5. Duties of the director of ambulance companies.
6. The divisional medical supply officer.

Wednesday, December 4:

1. }
2. } Problem; defense plans.
3. }
- 1.30 to 3 p. m. Duties of the director of field hospitals.
- 3 to 4.30 p. m. The evacuation hospital.

Thursday, December 5:

1. }
2. } Problem; defense plans.
3. } General considerations in the wounds of war (17, 33, 43, 74, 97, 131, 137).
4. }
5. } Film; "Fit to Fight."
6. }

Friday, December 6:

Return to proper stations.

The following problems were given in connection with the training in Field Service Regulations and sanitary tactics:^c

MAP PROBLEMS NOS. 1 TO 20, INCLUSIVE (DECEMBER 1, 1917, TO DECEMBER 17, 1918)

I. Miscellaneous problems in map reading: February 5, 8, 11, 19, 20, 21, 1918.

II. General problems in sanitary tactics (open warfare): Problem I, Problem I (solution), Problem II, Problem II (solution), Problem III, Problem III (solution), Problem IV, Problem V.

III. Specific problems in sanitary tactics (with required map): Problem VI (with solution), sanitary service of an Infantry division intrenched in defense (issued by G-5, general headquarters, A. E. F.). Problem VII (with solution), distribution of equipment and personnel and transportation (based on Problem VI). Problem VIII (with solution), a move by rail with "Notes on tactical moves," and Tables of Organization. Problem IX (with solution), relief of a division in the line, with "Notes on reconnaissance and relief." Problem X (with solution), "A division in defense" (following the St. Mihiel offensive). Problem XI (with solution), a raid by two battalions (sequel to problem E). Problem XII, a division in attack (with solution). The beginning of the Foret d'Argonne offensive with "Notes on attack." Problem XIII (with solution), difficulties arising during attack. Part I. Road block; Part II. Liaison, with "Notes on liaison."

NOTE.—Problems X to XIII, Part I (inclusive), are based on actual situations that arose in the American Expeditionary Forces, and the orders used are extracts from the actual orders as issued.

^c Problem No. IX is reproduced in this volume as an example of the problems given.

MAP PROBLEM IX

(Map of Langres, 1:20,000)

The sanitary service of a regiment during the relief of a division in the line.

(a) General situation:

The American 2d Division holds the Langres sector of the line, Chanoy—Humes—Brevoines—St. Geomes—Cohons, facing west.

The American 1st Division is located in corps reserve in the Lecey area.

At 8.30 a. m. on September 13 the following telegram is received from the First Corps (headquarters at Plesnoy):

The American 2d Division will be relieved in the line by the American 1st Division. Relief to be completed by September 20. Arrangements between divisions. Completion of relief to be reported by wire. Acknowledge.

(b) Special situation:

The 1st Infantry is billeted as follows: Headquarters 1st Infantry, Mont Landon; 1st Battalion, Mont Landon; 2d Battalion, 3d Battalion, Celsoy.

At 6 p. m., September 14, the colonel, 1st Infantry, sends for the regimental surgeon and gives him the following instructions:

This regiment will relieve the 8th Infantry which now occupies the subsector on the extreme left of the divisional sector. The relief will begin on September 17 and will be carried out as follows:

On September 17 the 2d Battalion, 1st Infantry, will relieve the reserve battalion, 8th Infantry. Relief to be completed by noon.

The 1st Battalion, 1st Infantry, will march so as to reach the support line at 10 p. m., relieving the support battalion, 8th Infantry.

On September 19, the 3d Battalion, 1st Infantry, will relieve the 2d Battalion, 1st Infantry, by noon; after dark the 2d Battalion will relieve the 1st Battalion, 1st Infantry, and the 1st Battalion, 1st Infantry, will move forward and relieve the battalion, 8th Infantry, now in the line.

You will go ahead with our advance party. Motor transportation will be provided for the party. It will leave here to-morrow at 1 p. m. Examine the sanitary situation carefully and be prepared to go over your findings with me on the 16th. You will meet me at the post of command, 8th Infantry, at 6 p. m., September 16."

The regimental surgeon, 8th Infantry, says he will turn over to the 1st Infantry the following list of trench stores, now distributed throughout the regimental sector:

Thomas half ring length and leg splints (BK)	18
Thomas arm splint (hinged) Murry's modification	12
Wire, gauze rolls	24
Stretcher bars	18
Z. O. adhesive:	
5-yard rolls	4
2-inch rolls	12
Standard litters	24
Blankets	50
Burner's oil	6
A. T. S. (1, 500 units each)	2, 000
French gas masks	200

Front dressing packets, assorted sizes. Exact number unknown, but thinks there are a good many.

Requirements.—(1) As regimental surgeon of the 1st Infantry relieving the 8th Infantry, make the actual reconnaissances and submit a written report to the division surgeon, 1st Division, covering the following points:

(a) Date and hour at which reconnaissances were made.

(b) Adequacy of present sites occupied by aid posts, and changes recommended, if any are desired.

(c) A list of trench stores (not included in regimental combat equipment) that will be needed to supplement those taken over from the 8th Infantry.

(2) As battalion surgeon of the 1st Battalion, 1st Infantry, relieving the battalion, 8th Infantry, in the line, write out in detail your action immediately prior to and during the relief.

A SOLUTION TO MAP PROBLEM IX

OFFICE OF SURGEON, 1ST INFANTRY,
September 16, 1918—8 p. m.

From: Regiment surgeon, 1st Infantry.

To: Division surgeon, 1st Division.

Subject: Report of reconnaissance of left subsector, 2d Division.

Requirement I

1. The following recommendations are based on reconnaissances made after 8 p. m., September 15, and between 5 and 7 a. m., September 16.

2. (a) Aid station, first-line battalion, is very far to the right of the sector and 300 m. from battalion P. C. The dugout, however, is excellent. No change recommended at present.

(b) Aid station, support battalion, is located away from trenches on high ground in an open field. Have planned to reserve this for handling of gassed cases only. Regiment aid station is so located as to be able to care for support battalion for the present.

(c) Aid station, reserve battalion, has both a good location and an excellent dugout. Owing to the proximity of the ambulance dressing station (250 m.), have planned, subject to approval of director of ambulance company, to hold in reserve the station of reserve battalion, equipped and ready for use, as an alternative ambulance head in case shelling makes either untenable. The ambulance dressing station can then serve the reserve battalion direct. I can reinforce their station with my personnel if necessary.

3. The following list of trench stores will be needed to supplement those taken over from the 8th Infantry:

Adhesive Z. O.:		Splints:	
1-foot roll.....	6	Arm hinge.....	12
2½-inch.....	12	Cabot.....	24
Ambrine packages.....	8	Gauze, wire, roll.....	12
Bandages:		Leg, T, half ring.....	24
Muslin, 4-inch.....	50	Liston.....	6
Muslin, 6-inch.....	50	Wire, ladder.....	75
Triangle.....	75	Wood—	
Basins, 1-quart (Ambrine).....	4	3-foot.....	12
Blankets.....	100	4-foot.....	12
Bottles, hot water.....	24	Stirrup, Sinclair.....	24
Boxes, Amb. dressing (par. 866, manual		Stove, shock.....	10
of the Medical Department).....	10	Straps and buckles.....	75
Brushes, camel's-hair, large.....	4	Syringes:	
Canteens.....	75	Luer 10-cc.....	4
Dressings, shell:		Hypodermic.....	12
Large.....	50	Tablets, morphine, ¼-grain.....	250
Small.....	100	Wadding, cotton..... rolls..	75
United States.....	50	Tea..... tins.....	4
Glue, Sinclair, pints.....	4	Coffee (g. w.)..... do.....	12
Gum solutions..... bottles..	24	Chocolate..... do.....	12
Lanterns, common.....	20	Sugar..... 5-pound tins..	4
Lights:		Buillon cubes..... boxes..	100
Carbide.....	7	Cigarettes..... cartons..	12
Flash.....	4		
Litters:		<i>Gas-defense equipment</i>	
French.....	24	Ammonia, ampules..... boxes..	100
Standard.....	50	Bottles:	
Needles, Luer.....	16	4-ounce.....	10
Pencils, indelible.....	12	For eye solution.....	20

<i>Gas-defense equipment—Continued</i>		<i>Gas-defense equipment—Continued</i>	
Boxes, fuel.....	10	Oxygen, tanks and connections.....	3
Caps, gas.....	10	Respirators:	
Catheters, rubber.....	10	Box.....	50
Coats, gas.....	10	Tissot.....	10
Droppers, medicine.....	10	Sodii hyposulphite..... pounds..	30
Fans, antigas.....	6	Sodii sulphite..... do.....	10
Hexomine..... pounds..	3	Sodii carbonate..... do.....	30
Jars, spray solution.....	3	Sodii bicarbonate..... do.....	3
Klaxons.....	3	Sodii chloride..... do.....	3
Lime, ehloride..... pounds..	300	Sprays, vermoral.....	3
Masks, M2 French.....	50	Tubing:	
Mittens, gas..... pairs..	10	Rubber..... feet..	20
Overalls, gas..... do.....	10	Glass..... do.....	10

NOTE.—This is special surgical equipment and not intended to replace battalion combat equipment, paragraph 866, Manual for the Medical Department, but will be in addition to it.

X,

Major, Medical Corps.

Requirement 2.—Upon notification (morning of September 15) by battalion major of the proposed relief; advise that the battalion be given, on September 16 (1) a complete physical inspection including feet; (2) a special gas drill, with careful inspection of gas masks.

September 15: Check over the battalion's share of the regimental combat equipment. Inspect equipment of Medical Corps detachment. Go over with them: (1) The care of gassed cases; (2) the importance of secrecy in all moves; forbid discussion of move; (3) action to be taken in case of capture.

September 16: Hold physical inspection of battalion; talk to them on "care of feet" in trenches. Evacuate all sick with command. Move forward with the battalion.

September 17: Distribute two dressers and a litter to each company. The rest of the detachment, I divide with assistant battalion surgeon. I take the head of the battalion and he stays with the rear group. Division surgeon has arranged to have a horse ambulance assigned to the battalion for the march. This is held at the rear of the battalion.

10 p. m.: I relieve the battalion surgeon 8th Infantry. I find my regimental surgeon has arranged for him to leave his assistant battalion surgeon and two enlisted men with me until the night of September 18. As soon as my assistant battalion surgeon arrives, I leave him at the battalion aid station and go over to regimental aid station. I get all the details of situation from regimental surgeon. I open only enough equipment for emergency work, in view of the short stay at this point.

September 18, at daybreak, I go up to the first line battalion aid station and with the battalion surgeon, 8th, make reconnaissances of fire trenches, company aid posts, routes of evacuation, number and location of the "direction markers" for litter bearers, gas curtains of dugouts, water bags, trench latrines, drying facilities, etc.

September 18, at nightfall, I send my assistant battalion surgeon up to make similar reconnaissances. Send one litter squad along to remain there and become familiar with the trenches prior to the relief.

I carry out the relief on the night of the 19th, relieving all men at battalion aid station and in company aid posts of the first line battalion.

Sample of a march and relief table (accompanying a field order)

[All units except sanitary train omitted]

Serial	Date	Unit		Move		Route	Remarks
		1st Division	2d Division	From—	To—		
13	July 16	One company (horse), field hospital section, sanitary train.		Monchy-au-Bois	Achiet-le-Grand	Bucquoy	To be clear of Monchy by 8 a. m. ^a
14	do	One company (motor), field hospital section, sanitary train.		Basseux	do	Berles-au-Bois—Monchy-au-Bois—Bucquoy	Not to enter Berles-au-Bois before 12 noon. ^a
15	do	do		Boiry-Sté. Rietrude	Henin-sur-Cojeul	Direct	To take over dressing station; not to pass Boisseux-au-Mont before 4 p. m.
16	do	Field hospital company (motor), field hospital section, sanitary train.		Ayette	Croisilles	Courcelles and Ervillers	To take over dressing station; not to pass Ervillers before 9.30 p. m.
17	do	2 companies (motor), ambulance section, sanitary train.		Hannescamps	Boisseux-St. Marc	Monchy-au-Bois—Boisseux-au-Mont	Not to enter Monchy-au-Bois before 12 noon.
18	do	1 company (motor), 1 company (horse), ambulance section, sanitary train.		do	Ervillers	Bucquoy—Courcelles	Not to enter Courcelles before 12 noon.
19	do		1 company (horse), field hospital section, sanitary train.	Achiet-le-Grand	Monchy-au-Bois	Bucquoy	On relief.
20	do		1 company (motor), field hospital section, sanitary train.	do	Basseux	Bucquoy—Monchy-au-Bois—Berles-au-Bois	Do.
21	do		do	Henin-sur-Coteul	Boiry-Sté. Rietrude	Direct	Do.
22	do		do	Croisilles	Ayette	Courcelles and Ervillers	Do.
23	do		2 companies (motor), ambulance section, sanitary train.	Boisseux-St. Marc	Hannescamps	Boisseux-au-Mont—Adouler—Monchy-au-Bois	Do.
24	do		1 company (motor), 1 company (horse), ambulance section, sanitary train.	Ervillers	Hannescamps	Courcelles—Bucquoy	Do.

• To take over casualty clearing station (Achiet); arrangements between medical officers concerned.

NOTES ON RECONNAISSANCE AND RELIEF

(For issue in connection with map problem No. IX)

Study Field Service Regulations, pars. 9 to 32.

The formal relief of combat units in the line is a most frequent event. It is carried out by divisions within Army Corps; by battalions within divisions; by companies within battalions. In trench warfare it serves a twofold purpose in that troops on the firing line are prevented from "going stale" and opportunity is afforded for periods of training and rest of a degree which is impossible while actually in the line. In open warfare temporary checks will certainly occur entailing reliefs in the front line of the advancing columns. As in the case of all troop movements, success depends upon teamwork in which every detail has been thought out and provided for in advance. This is ordinarily done and issued in the form of an administrative order prepared by the G-1 branch of the divisional staff. Occasionally when a relief is of a very hurried nature, supplementary instructions may be necessary. Upon the division order, subordinate commanders in turn base their instructions to their subordinates and so on down to the last soldier. In the case of hurried reliefs the younger officers must take the initiative and not wait for those higher up. This demands that they have thought out their course of action often enough to be in a position to interpret in their act the will of their commander.

The movements of the troops in and out of the line may be carried out by road march, bus and trucks, or tactical trains, according to distances to be covered and the condition of the men. Billeting parties should invariably be sent forward by march or truck 24 hours ahead of their units, with suitable advance parties for taking over any trench stores, dumps, etc. As soon as possible after the orders for the relief are received the commanding general and a representative of each branch of the staff proceed to the new area in order to hold the necessary conferences and make any desired reconnaissances. The G-1 representative at once notifies his technical advisers. The division surgeon is the one with whom we are especially concerned—and they proceed to the new area to familiarize themselves with the new situation.

The division surgeon will consult, first, with his new corps surgeon and then with the division surgeon of the area which he is to take over. His reconnaissances will include the situation of battalion aid and ambulance dressing stations, stations for slightly wounded, locations of field hospitals, and ambulance companies, routes of evacuation, quantity and quality of the water supply, sanitation and bathing facilities. He will also make inquiry regarding the enemy's shelling routine and the location of any regularly shelled points; any outstanding features of the situation and finally (if necessary from his division G-1) the defense scheme which has been adopted for the area—especially the section dealing with gas defense. This information will then be distributed and certain phases turned over to selected subordinates for further investigation.

In the meantime the divisional staff will have drawn up a general plan to which the details of the relief will be made to conform. It is the policy to allow subordinate commanders to arrange their own methods of relief in accordance with the general plan. This is especially true with regard to the medical units. Consequently it is all the more important that they understand fully the entire system of relief, in order that the plans they submit be reasonable. The division surgeon is asked to submit draft tables of relief to be woven into the general table of relief and made to coincide with the total scheme. This latitude is given because the medical units and certain other branches like the Engineers and Artillery serve a dual interest as they participate in general schemes reaching outside the divisional limits. The corps medical officers initiate and control the territorial responsibility of the divisional Medical units.

The plan of relief is adapted to each local situation but in general observes the following rules:

The front-line Infantry of contiguous regimental fronts are not relieved simultaneously.

The relieving unit should be in support or reserve the day before relieving a front line unit to allow for final reconnaissances and the completion of arrangements generally.

The Infantry and machine guns in a regimental sector should not be relieved on the same day.

All the batteries in a Field Artillery battalion should not be relieved on the same day. Guns are usually exchanged instead of moving them from their emplacements.

Combat equipment is exchanged as far as possible. Trench stores are taken over and signed for. This applies especially to the equipment of aid stations.

Regimental surgeons are usually sent forward with the advance parties, to familiarize themselves with the locations of the aid stations, and take over any medical stores which will be left by the outgoing units. It is customary in a divisional relief for at least one medical officer of the outgoing regiment to remain 24 hours if necessary after the relief of his unit—until the new medical group is functioning smoothly.

Ordinarily, when time permits, the relieving division moves up into a corps staging area immediately in the rear of the first line division, and the units exchange places observing the rules just cited. It is important to arrange for guides to meet the new units going in at night and conduct them in small groups to their new post. This requires clear and concise arrangements. Simplicity is the secret of success.

The supply question during relief is usually carried out by mutual arrangement. The division holding the area is responsible in either case for all troops in its area and changes with the change of command. In fact all units entering the new area are under the command of the commanding general of the division being relieved, until the command passes which is usually upon the relief of the last unit in the front line.

It is the policy of relieving divisions to occupy the billets and horse standings of the previous similar unit. It is a good general rule not to change anything, except in the case of glaring defects, until you have tried it out a while.

There are so many details to be arranged that no matter how much time there is it will never seem enough. You will always feel that the division being relieved is taking away more equipment than it should and also that they are not taking sufficient precautions to conceal the relief, which is often true owing to the relaxation of the troops upon being relieved. These are some of the difficulties which require considerable tact if they are to be properly dealt with.

Every precaution must be taken to prevent the enemy becoming aware that the relief is in progress—for the hour of relief is the most vulnerable point of a combat unit's normal life. This fact is known to the enemy and always taken advantage of in case the relief is detected while in progress. It is essential that there be no departure from the usual appearance of the sector. All reconnaissances should therefore be made in the very early hours of the morning or late in the evening. If there is any departure from the habits of the relieved units, it is quickly noted in the observation posts of the enemy and surprise attacks will be quickly delivered in order to obtain identifications and knowledge of the relieving unit. If any changes are to be made in the new sector they should be made only after the relieving division has become settled in the sector and knows the need of the changes from actually living there. I heard Major General Duncan say that at the battle of Regiments, the regiment made two attacks in 5 days, advancing their line absolutely according to schedule as planned, but were relieved at the end of 12 days in the line. The enemy obtained information of the relief going on, and the losses of this regiment in withdrawing were as great as they had been during the two attacks.

In order to make observation from hostile airplanes difficult, the following rules should be adhered to:

(1) While a hostile plane is directly overhead, stand perfectly still; if the plane is seen approaching, and time permits, get in the shadow of a tree or house before he gets overhead.

(2) Trucks and ambulances should be stopped to one side of the road in the shadow of trees or along the edge of a wood or in a town.

(3) At night—when a flare or star shell suddenly bursts—stop moving until darkness again intervenes.

(4) Camouflage is only valuable if put up before any changes of the ground are made. Remember that camouflage in itself arouses the enemy's curiosity.

(5) Smoke can give away the location of rolling kitchens. The practice of lining up with mess kits should not be used in forward areas. A shell directed at a rolling kitchen may get the whole line.

During a relief it is essential that the Medical Department function smoothly. It must at no moment be unprepared for casualties due especially to a hospital raid or gas attack. The medical units must continually bear in mind the main issues:

1. The interest of the outgoing units.
2. Security during the relief.
3. Security immediately after the relief.
4. The comfort of all troops.

Simultaneously with the school for medical officers, there was established a section for officers of the Dental Corps,⁴ the history of which follows.

DENTAL SECTION ^d

ORGANIZATION AND INSTRUCTION

With the arrival of the first contingent of the American Expeditionary Forces in France, the question of training officers and men in various arms of the service became one of the most serious problems. In a large measure the men who composed the 1st Division had seen previous service, thus making the training problem more simple. However, officers of the Dental Corps, drawn largely from civil life, were badly in need of organized instruction before they could function in their proper capacities. Their ideas and standards of dental service had their foundation in long-established customs of civilian life, where equipment was complete and where environment was more favorable for the practice of the profession. The new conditions as presented in France at the start seemed to bring up the difficulties of proper adaptation and proper observance of military discipline. There was a serious demand for efficient training in Army Regulations, military discipline and customs of the service, Manual for the Medical Department, and Manual for Courts-Martial. Furthermore, in anticipation of future needs some courses in oral surgery and in oral surgical prosthesis were deemed necessary. Plans were made, therefore, for organized training of officers of the Dental Corps, and the first program for school instruction of dental officers was prepared by the chief of the dental section of the personnel division of the chief surgeon's office.

The demand for organized instruction was begun in the 1st Division by a course of training instituted by the division surgeon, who later became commandant of the Army Sanitary School, and by the division dental surgeon, later acting director and assistant director of the dental section of this school. This instruction anticipated the demand which was later felt for training in first aid, bandaging, and dressing, and, with the exception of the lectures on oral surgery, was quite similar to the course which was given during the first session of this school, from December 10 to 17, 1917 (q. v., p. 648.).

The aims of the representative of the Dental Corps in the Chief Surgeon's Office, in presenting the plans for the training school for dental officers, are set forth in the following communication from that officer to the commandant of the Army Sanitary School:

^d The statements of fact appearing herein are based on: "History of the Dental Section of the Army Sanitary School, Army Schools, American Expeditionary Forces, France, December 10, 1917, to December 10, 1918." (Compiled from the official records of the school.) The history is on file in the dental division, Surgeon General's Office, Washington, D. C.—*Ed.*

HEADQUARTERS AMERICAN EXPEDITIONARY FORCES,

November 18, 1917.

Memorandum in re dental section of the Army Sanitary School, A. E. F.

1. Assignments: In view of the scope and character of instruction contemplated in the dental section of the Army Sanitary School it is recommended that two specially qualified dental surgeons be assigned as instructors thereat. One of the senior dental surgeons of the Army has been requested for this detail by cable to the Surgeon General November 17. The only other available man in France with special qualifications for this detail is Lieutenant Rice, on duty as division dental surgeon, 1st Division, Gondrecourt. Lieutenant Rice will be a major under recent enactment of law, October 6, 1917. He has had experience as recorder at the Army Dental School conducted by the undersigned last year at Fort Bliss, Tex., for the instruction of National Guard officers, and has within the past few months conducted the 1st Division school for instruction of dental officers (reserve) of that command. It is believed Major Rice is sufficiently capable of conducting the dental section of the Army Sanitary School until the arrival of the senior dental officer requested above.

Attention is invited to the following program of instruction for the dental section, Army Sanitary School, which has been carefully considered and modified to meet the requirements of that institution.

2. Program of instruction:

First day:

7.45 a. m. to 11.45 a. m. -- Duties of dental officers serving with sanitary organizations at regimental and battalion aid stations and field hospitals (administration and records, admissions, evacuation and transportation).

1.30 p. m. to 4.30 p. m. -- Practical instruction in gas defense.

Second day:

7.45 a. m. to 11.45 a. m. -- First aid to the wounded embracing: Hemorrhage, wounds and dressings, fractures, tetanus, shock, nutrition.

1.30 p. m. to 4.30 p. m. -- Demonstrations in the use of field equipment, dental and medical.

Third day:

7.45 a. m. to 9.30 a. m. -- Bandaging and splinting (general).

9.30 a. m. to 11.45 a. m. -- The sanitary service in the zone of the advance (general).

1.30 p. m. to 4.30 p. m. -- Dental surgery at the front, first aid for jaw cases, surgery, dressings, and transportation (ambulatory and litter).

Fourth day:

7.45 a. m. to 11.45 a. m. -- General and local anæsthetics (technique and administration).

1.30 p. m. ----- Special duties in which dental officers may be utilized in emergencies.

2.30 p. m. ----- Oral manifestations of systemic diseases.

3.30 p. m. to 4.30 p. m. -- Pathodontia; relation of oral diseases to systemic infection, or oral surgery to rhinology, otology, laryngology, and ophthalmology.

Fifth day:

7.45 a. m. ----- Dental sterilization and method employed in the field.

8.45 a. m. ----- Wounds of the jaw.

9.45 a. m. to 11.45 a. m. -- The interrelation of the oral and dental surgeon with the brain surgeon, general surgeon (plastic), nose and throat surgeon, and eye and ear surgeon in the work contemplated for the head surgical teams.

1.30 p. m. to 3.30 p. m. -- Oral surgical prosthesis.

3.30 p. m. to 4.30 p. m. -- Military duties of the dental officers. (Equitation, elementary, motor-car technique—driving, mechanism, and minor repairs.)

Sixth day:

- 7.45 a. m.----- Oral hygiene.
 9 a. m.----- Special oral surgery.
 1.30 p. m.----- Personal hygiene.
 2.30 p. m. to 4.30 p. m.-- Oral surgical prosthesis.

NOTE.—Student officers for this course to be selected from those on duty in divisions or separate brigades, who have previously taken the course prescribed for the division dental school.

3. Division dental schools (and for separate brigades); a course of instruction conducted by the division dental surgeon under the direction of the division surgeon:

(a) Army Regulations (pertaining to officers in general, and Medical Department officers in particular).

(b) Manual for the Medical Department (dental instruction and administration).

(c) Manual for Courts-Martial and Military Law (administration of military discipline and justice, charges, specifications, trials, etc.).

(d) Customs of the service.

(e) Paper work (correspondence, records, reports, and returns).

4. Correspondence course of instruction for dental officers stationed at base hospitals, engineer regiments and other isolated commands:

To cover preceding subjects of instruction and conducted from the Army Sanitary School in accordance with plans followed in the usual correspondence course for medical officers of the Army.

5. A post-graduate school of instruction:

To be established at the American Red Cross Hospital No. 1, Neuilly, under the direction of the commanding officer. Said course to embrace lectures on hospital administration, admissions, evacuations, records, diet, internal economy, etc., by Lieut. Col. George P. Peed; and oral surgical technique (major and minor) by Majors Hutcheson and Powers. Clinical oral surgical prosthesis (technique, construction, records, cases, etc.), and special dental X-ray and photographic instruction by Dr. George P. Hayes. Student officers for the post-graduate course to be selected from those specially qualified or who show special aptitude for oral surgery and oral surgical prosthesis; selection to be made on the recommendation of the chief surgeon, A. E. F., and the commandant of the Army Sanitary School.

NOTE.—The course of instruction at the division schools may be handled in six to eight sessions, held two afternoons per week for the period. The duration of the term for instruction at the Army Sanitary School (dental section) is contemplated as one week. The period of instruction at the post-graduate school may be covered in two weeks intensive study. This may be extended in certain particular cases where deemed desirable for the best interests of the service.

Prior to the completion of the organization of the First Army Corps, although coincident with the plans for corps training, a program was instituted for a school for dental officers as a part of the First Corps Army Sanitary School. However, the sanitary school was later moved as a part of the Army schools, at Langres, and this course was never given, although the program of instruction was incorporated in the courses which were given during the first two months of the school at Langres.

It was the original intention to institute courses of instruction for dental officers not only at the Army Sanitary School, but throughout the various Army corps, as well as in the divisions. In some divisional organizations, good results were gained, but, as a rule, the difficulties of transportation and the conditions in general were such as to make continuous training for dental officers impracticable. The plans for corps schools for dental officers were instituted and a program for a course at the headquarters of the First Army Corps was laid out, but there is no record that any school was ever established in corps organizations in France for dental officers.

It will be recalled that it was not until February, 1918, that American troops occupied the front lines to any extent. Prior to this time, the majority of all instruction for dental officers was experimental and speculative, for no one knew and no one could prophesy what combat conditions would be for dental officers. No parallel could be drawn from the experiences of our Allies, for in no army is the allowance of dental personnel as complete as in our own. Nothing could be foretold of the difficulties which would arise in the transportation of the portable outfits, soon proven to be hopelessly bulky. No one could foresee that the dental officer would be called upon for almost every other duty as well as that of dental work, such as battalion or regimental surgeon, sanitary inspector, censor officer, mess officer, burial officer, and many others. It is apparent that the problem of adequate instruction was a serious one.

After American troops finished their preliminary training and began to occupy different sectors on the Western Front, it was found that the training of dental officers in routine subjects of military administration was not sufficient. For instance, while the tables of organization allowed enough medical officers to a combat division to do all necessary medical work during quiet periods, actual combat conditions found the number insufficient, and the dental officer began to be employed in an auxiliary medical capacity. Furthermore, every division found its transportation problem a difficult one, and it was impossible in many instances to bring the heavy portable outfit to a place where it could be used to advantage. In fact, this worked two ways. In the first place, there were no transportation facilities to insure the carrying of the dental equipment with the regiments into combat, and, if through some fortunate chance the outfit did arrive in the combat area, the dental officer found himself in a position where dental work was impossible, and where the excitement of battle left little time for constructive dental work. Consequently, he either performed what duties the Medical Department demanded of him or there was little left for him to do.

This was the problem which confronted the director of the dental section of the Army Sanitary School as soon as the facts became known. Two courses were open. In the first place, the elimination of the larger part of the portable dental outfit, in favor of a small, easily transportable equipment, by means of which the dental officer could render the emergency service demanded of him while in combat. Secondly, and by no means less important, it became the obligation of the dental section of the Army Sanitary School, and the duty of division dental surgeons, to see that dental officers on duty with combat troops were trained in the proper performance of the duties required of them should they replace or function with the medical officers.

To this end, the courses at this school were modified to teach less in detail the more professional and theoretical subjects and to lay more emphasis upon first-aid bandaging and splinting, map reading, orientation, field sketching, sanitation, hygiene, and evacuation of the wounded. The program for the fifteenth session (p. 658, *infra*) demonstrates the policy of the school shortly before its close. In brief, the school gradually developed into a field service institution, and laid its greatest emphasis upon the preparation of dental

officers for combat service. The officer in the combat division had to live the life of the infantryman, and he had to be able to hike where the organization went. The classes of student officers of this school received training in Infantry drill for over seven months as a part of their course of instruction. They were subject to strict military discipline at all times; in other words, they learned the meaning of the word "soldier."

The difficulties caused by the too bulky portable outfit were adjusted from the chief surgeon's office by the Dental Corps representative on duty there, and this equipment was reduced to make a modified portable outfit, and the emergency kit. This latter was carried on the person of the dental officer and his enlisted dental assistant, and made it possible to take care of emergency cases, even though the dental officer were being employed in medical capacities. In other words, dental service could be rendered with this equipment, without regard to transportation difficulties, and even under combat conditions.

While certain subjects and phases of oral surgical prosthesis constituted a part of the school curriculum, the dental section of the Army Sanitary School never was primarily a school for oral surgery. Nevertheless, efforts were made to bring the best methods in plastic and prosthetic restorations before the student officers.

CURRICULUM

During the life of the dental section of the Army Sanitary School (December 10, 1917, to December 10, 1918) 16 courses of instruction were given, and certificates were awarded to 320 officers of the Dental Corps. The succeeding pages contain outlines of programs of typical courses of instruction together with a summary of the courses and a detailed consideration of the purposes of the subjects included.

Classification of the subject matter:

I. Military discipline.

- a.* Setting-up exercises.
- b.* Drill.

II. Military administration.

- a.* Army Regulations.
- b.* General orders and bulletins.
- c.* Manual for Courts-Martial.
- d.* Military Law.
- e.* Manual for the Medical Department.
 - 1. Dental records and reports.
 - 2. Dental supplies.
 - 3. Dental requisitions.
 - 4. Medical records and hospital administration.
- f.* The problem of medical supplies in American Expeditionary Forces.

III. Professional.

a. Dental.

1. The organization of the Army Dental Corps.
2. New methods of operative practice (Howe treatment).
3. Conducting a general Army practice.
4. Local and conductive anesthesia.
5. Oral surgery.
6. Oral surgical prosthesis.
7. Oral manifestations of systemic diseases.
8. Special prosthetic appliances.

b. Medical.

1. General anesthesia.
2. The Thomas splint.
3. First-aid bandaging, dressing, and splinting.
4. War surgery.
5. Internal medicine.
6. Surgical technique.

IV. General field service problems.

- a.* Sanitary tactics.
- b.* Field sanitation.
- c.* General and personal hygiene.
- d.* Map reading and field sketching.
- e.* Map problems and terrain exercises.
- f.* Sanitary appliances.
- g.* Evacuation of the wounded.
- h.* Field transportation.

MILITARY DISCIPLINE

Had it been possible to plan for a longer school course, greater emphasis would have been laid upon military training, but under the program or the time allotted for the instruction of each class (two weeks) it was practicable to give it only an hour each afternoon and about 20 minutes early each morning. The dental officer had served as an integral part of combat troops. It was consequently the obligation of the school to give this training. Only the most elementary instruction in Infantry drill was attempted. The sole intention was to give the dental officers the foundation upon which they could build their own military success.

MILITARY ADMINISTRATION

It was contemplated, when the program of the school was modified to include the more practical instruction in field service problems, and that subjects incident to dental administration would be handled by the divisions and the different sections of the Services of Supply. For various reasons, however, the plan never worked out with any uniformity. Army Regulations, Manual for Courts-Martial, and Military Law, and certain subjects of dental adminis-

tration were eliminated as a part of the school course. These subjects were regarded as being important and it was the intention of the director of the dental section to present as much of this instruction as regulations governing the policy of the school would permit, but they were subordinate to the practical problems of combat service.

PROFESSIONAL INSTRUCTION

For the most part subjects classified above as "dental" were taught by officers of the Dental Corps. During the sixteenth session, however, one lecture on the corelationship between the otorhinolaryngologist and the dentist was added to the curriculum. In the associated subjects of oral surgery and oral surgical prosthesis, a medical and a dental officer of the French Army furnished valuable aid. Furthermore, the maxillofacial department, under the chief medical consultant, furnished one lecture during each session.

The subjects classified as medical were taught by the medical officers of the Army Sanitary School and by the staff of consultants called upon as special lecturers.

GENERAL FIELD SERVICE PROBLEMS

Explanation has been made of the change of policy, which expanded the instruction in the more practical subjects of field service, but the real basis for the most efficient field service school was laid just as the armistice was signed. Reference to the subjects taught under this heading demonstrates the completeness of this instruction.

PROGRAM FIRST SESSION (DECEMBER 10 TO 17, 1917)

Monday, Dec. 10:

- 7.45 to 9.45 a. m. --- Dental administration, records, requisitions, reports, and returns.
- 9.45 to 11.45 a. m. --- Regimental and battalion aid stations, field hospitals, medical administration, records, and reports.
- 1 to 2 p. m. --- First aid to the wounded.
- 2 to 3 p. m. --- Dental surgery at the front. Sterilization of dental instruments, and methods employed in the field.
- 3 to 4.30 p. m. --- First-aid bandaging and dressing. Practical instruction and demonstration.

Tuesday, Dec. 11:

- 7.15 to 8 a. m. --- Clinic at sick call.
- 9 to 10 a. m. --- Military discipline, property accountability, personal and efficiency reports, and official correspondence.
- 10 to 11.45 a. m. --- Bandaging and splinting.
- 1.30 to 4.30 p. m. --- Gas instruction.
Lecture—gas warfare, materials used, methods of use.
Practical—fitting and drill with respirator and mask.
Lecture—proper inspection of the respirators and masks.
Gas officers.

Wednesday, Dec. 12:

- 7.45 to 10 a. m. --- Oral surgery and oral surgical prosthesis. The work of the dental surgeon at a base hospital, showing the treatment of individual cases.
- 10 to 11.45 a. m. --- Practical instruction in bandaging and splinting. Students required to employ the various methods and appliances described.

- 1.30 to 3 p. m.----- Gas instruction.
 Lecture—wind observations, gas alert, gas alarms.
 Practical—drills, respirators and masks.
 Lecture—gas poisoning and treatment.
 Gas officers.

Thursday, Dec. 13:

- 7.45 to 11.45 a. m.--- Oral surgery and special oral surgical prosthesis (continued).
 1.30 to 3.30 p. m.--- Gas instruction.
 Lecture—gas-proof dugouts; description and use.
 Practical—drill and testing of respirators and masks in lacry-matory gas.
 Lecture—treatment of gassed patients; discussion and questions answered.
 Gas officers.

Friday, Dec. 14:

- 7.45 to 11.45 a. m.--- Wounds of the jaw, first-aid to jaw cases, surgery and dressings.
 1.30 to 2.30 p. m.--- Oral manifestations of systemic diseases.
 2.30 to 4.30 p. m.--- General and special orders. Army Regulations.

Saturday, Dec. 15:

- 7.45 to 10.45 a. m.--- Local anesthesia, instruments and materials, their care and use; technique of producing local anesthesia of mouth and tissues of the face.
 10.45 to 11.45 a. m.--- The interrelation of the dental and oral surgeon with the general surgeon (plastic), nose and throat surgeon. Special plastic surgery.
 1.30 to 2.30 p. m.--- Manual for Courts-Martial, Military Law.
 2.30 to 4.30 p. m.--- Oral hygiene as applied to uninjured and injured mouths.

Monday, Dec. 17:

- 7.45 to 9.30 a. m.--- General anesthesia—ether, nitrous oxide, nitrous oxide and oxygen.
 9.30 to 10.30 a. m.--- Trench mouth. Relation of oral diseases to systemic infections. Relation of oral surgery to otology, rhinology, laryngology.
 10.30 to 11.45 a. m.--- General and personal hygiene.
 1.30 to 2.30 p. m.--- Customs of the service.
 2.30 to 4.30 p. m.--- Duties of dental surgeons; conducting of general Army dental office. Methods of handling patients.

EXPANSION OF COURSE

The fourth session (February 2 to 17, 1918), was marked by some radical changes in the program of instruction. The important provisions of Army Regulations were considered more in detail than had been the case in the preceding sessions, and an officer of the Judge Advocate General's Department was detailed as an instructor in the Manual for Courts-Martial and Military Law. Furthermore, a lecture on map and compass reading was added to the program. This was the extent of the expansion in the lecture subjects.

It had been noted among various combat organizations that dental officers were used to command men in time of emergency, and were relieving medical officers, at times, of their military duties; this was caused partly by the insufficiency of the quota of medical officers during times of combat and partly by the fact, which became increasingly evident during later developments, that dental equipment, as constituted, could not be transported and used efficiently in combat areas. With a view to making the dental officers as conversant as possible with matters of military discipline and with Infantry drill, the commandant of Army schools detailed an officer of the Cavalry, United States

Army, to drill the student officers for one hour each day. This instruction continued to be a part of the school course until its close.

Up to the commencement of the fourth session six lectures of one hour each had been given each day. With the initiation of the training in drill the lecture hours were reduced to five, the hour for drill instruction occupying the sixth period.

During the period from the fourth to the seventh sessions an attempt was made to combine field service and practical instructions for combat conditions with the more detailed training in military administration and discipline. This plan was successful, but only for the reason that the problem of the training of dental officers to function properly in times of battle was not sufficiently understood to enable the school to give a comprehensive course concerning it. Furthermore, it was expected that many of the dental officers who seemed especially fitted would be employed in the special work of oral surgery. This theory was later found to be a mistaken one, for the demand for men who could do routine dentistry was so great that this special work was assigned to other fields, and the dental officer, not only in combat divisions but throughout France, was employed, for the most part, when he did dental work at all, in the practice of the routine methods of his profession.

FOURTH SESSION

Monday, Feb. 4, 1918:

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| 8.30 to 9.30 a. m. | Opening lecture. Scope of dento-military instruction; responsibility as officers; conduct during course. |
| 9.40 to 10.40 a. m. | The work of a dental surgeon at a base hospital. Organization of the unit to care for personnel and patients. Equipment in instruments, materials, and men. |
| 10.50 to 11.45 a. m. | Practical instruction in first aid; precautions against hemorrhage and shock. |
| 1.30 to 2.30 p. m. | Dental administration; Manual for the Medical Department. |
| 2.45 to 3.45 p. m. | Antitetanic injections; care of wounds of the face and neck associated with fractures of the maxillæ and mandible. |

Tuesday, Feb. 5:

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|---------------------------|--|
| 8.30 to 9.30 a. m. | The Army Dental Corps; organization; status; duties. |
| 9.40 to 10.40 a. m. | Treatment of fractured jaws; vertical and longitudinal fractures of the maxillæ. |
| 10.45 to 11.45 a. m. | First aid to the wounded; latest methods of handling fractures in the field. |
| 1.15 to 4.30 p. m. | Gas course; gas warfare, methods and use; drills, respirator, and mask. |

Wednesday, Feb. 6:

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|---------------------------|--|
| 8.30 to 9.30 a. m. | Treatment of fractured jaws; fractures of the maxillæ with little or no loss of substance. |
| 9.40 to 10.40 a. m. | Supplies and materials; requisitions; Manual for the Medical Department (continued). |
| 10.50 to 11.45 a. m. | Practical instruction in first-aid bandaging and dressing. |
| 1.15 to 4.30 p. m. | Gas course; wind observations; gas alerts and gas alarms; gas poisoning and treatment. |

Thursday, Feb. 7:

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|--------------------------|---|
| 8.30 to 9.30 a. m. | Transfer of supplies; vouchers and receipts; Manual for the Medical Department (continued). |
| 9.40 to 10.40 a. m. | Treatment of fractured jaws; compound, comminuted fractures with loss of substance. |

Thursday, Feb. 7—Continued.

- 10.50 to 11.45 a. m. ----- Practical instruction in first-aid bandaging and dressing, the students being required to apply various methods and materials shown.
- 1.15 to 4.30 p. m. ----- Gas course; gas-proof dugouts, description and use. Testing of respirators with lacrymatory gas. Questions and discussions.

Friday, Feb. 8:

- 8.30 to 9.30 a. m. ----- Army Regulations.
- 9.40 to 10.40 a. m. ----- Treatment of fractured jaws; compound comminuted fractures of the symphysis of the mandible.
- 10.50 to 11.45 a. m. ----- Practical instruction in first-aid bandaging and dressing.
- 1.30 to 2.30 p. m. ----- Map and compass reading.
- 2.45 to 3.45 p. m. ----- Military discipline and customs of the service.
- 3.45 to 4.30 p. m. ----- Drill.

Saturday, Feb. 9:

- 8.30 to 9.30 a. m. ----- Local anesthesia; advantages over general anesthesia; instruments necessary for producing.
- 9.40 to 10.40 a. m. ----- Property responsibility and accountability.
- 10.50 to 11.45 a. m. ----- Practical instruction in first aid.
- 1.30 to 2.30 p. m. ----- Local anesthesia, subject completed; Ottesen method (intra-osseous); anesthesia of soft parts of face for plastic operations.
- 2.45 to 3.45 p. m. ----- Regimental and battalion aid stations; field hospitals; the battalion and regimental surgeon in trench warfare.
- 3.45 to 4.30 p. m. ----- Drill.

Monday, Feb. 11:

- 8.30 to 9.30 a. m. ----- Forms of the Medical Department.
- 9.40 to 10.40 a. m. ----- Oral surgery in connection with the general surgeon.
- 10.50 to 11.45 a. m. ----- Army Regulations (continued).
- 1.30 to 2.30 p. m. ----- Army Regulations.
- 2.45 to 3.45 p. m. ----- Medical Department in the zone of the advance.
- 3.45 to 4.45 p. m. ----- Drill.

Tuesday, Feb. 12:

- 8.30 to 9.30 a. m. ----- Army Regulations.
- 9.40 to 10.40 a. m. ----- General anesthesia.
- 10.50 to 11.45 a. m. ----- Forms of the Medical Department (continued).
- 1.30 to 2.30 p. m. ----- General anesthesia; operating-room technique.
- 2.45 to 3.45 p. m. ----- Diseases and casualties of war.
- 3.45 to 4.45 p. m. ----- Drill.

Wednesday, Feb. 13:

- 8.30 to 9.30 a. m. ----- Plastic operations of head and neck; removal of foreign bodies.
- 9.40 to 10.40 a. m. ----- Responsibility and accountability, additional facts.
- 10.50 to 11.50 a. m. ----- Army Regulations.
- 1.30 to 2.30 p. m. ----- Manual for Courts-Martial and Military Law.
- 2.45 to 3.45 p. m. ----- General and personal hygiene.
- 3.45 to 4.30 p. m. ----- Drill.

Thursday, Feb. 14:

- 8.30 to 9.30 a. m. ----- Military correspondence.
- 9.40 to 10.40 a. m. ----- Oral hygiene as applied to both injured and uninjured mouths.
- 10.50 to 11.45 a. m. ----- Army Regulations.
- 1.30 to 2.30 p. m. ----- General anesthesia; operating-room technique.
- 2.45 to 3.45 p. m. ----- Relation of oral disease to systemic infections.
- 3.45 to 4.30 p. m. ----- Drill.

Friday, Feb. 15:

8.30 to 9.30 a. m.	Conducting a general army practice.
9.40 to 10.40 a. m.	Dental surgery at the front; dental sterilization in the field.
10.50 to 11.50 a. m.	Oral manifestations of systemic diseases.
1.30 to 2.30 p. m.	Manual Courts-Martial and Military Law.
2.45 to 3.45 p. m.	A study of the causes of displacement following fractures of the mandible.
3.45 to 4.45 p. m.	Drill.

Saturday, Feb. 16:

8.30 to 9.30 a. m.	Charge to the class.
9.45 to 12 m.	Examinations.
1 to 3.30 p. m.	Examinations.
4 to 5 p. m.	Lecture.

CLINICAL DEMONSTRATIONS

The school had been in operation until May before it was possible to secure any clinical material for instruction purposes. One of the disadvantages of a training institution located in such a town and locality as Langres was that clinical material was not easily available, and what little there was could be drawn only with great difficulty from the few French hospital formations located in the vicinity. But with the occupation of Camp Hospital No. 24 by an American unit, the opportunity arose for the use of the clinical demonstrations for the student officers.

The first of these clinics, which were held continuously after that time, was in charge of an officer of the Dental Corps attached to the hospital, who, during the seventh session, gave two clinical demonstrations of local and conductive anesthesia at Camp Hospital No. 24. In addition to this, two lectures were arranged for, to be given by an officer of the Medical Corps, on surgical technique and minor surgery, and this work was soon supplemented by a lecture on general anesthesia by another officer of the Medical Corps who, after that time, gave many demonstrations before the class at Camp Hospital No. 24.

The growth of the information which was contained in the orders and bulletins of the American Expeditionary Forces necessitated the giving of a lecture on these regulations, and this instruction, as it was intimately associated with the problems which were constantly arising in the field, formed a part of the course of instruction.

As a supplement to the training which was being given in Infantry drill, morning setting-up exercises were initiated, under the direction of a Cavalry officer.

During the first week in June the faculty of the dental section spent several days in studying the work of the French maxillofacial surgeons at Hospital No. 45 at Vichy. It was here that the idea of the cast splint for cases of jaw fracture was being worked out efficiently, and much information toward the improvement of the maxillofacial work in our own service was gained. This trip to Vichy formed the basis for a series of lectures which were given later before the dental and medical classes by the chief of service of Hospital No. 45, and who succeeded in arranging a scheme for collaboration between the French and American oral surgeons in the hospitals at Vichy.

Friday, Apr. 19:

6.30 to 7 a. m.	Setting-up exercises and drill.
8.30 to 9.30 a. m.	Opening lecture: (a) Scope of dento-military instruction—responsibilities as officers; (b) conduct—(1) discipline, (2) requirements during school term.
9.40 to 10.40 a. m.	The work of the dental surgeon in a base hospital; organization to care for large personnel and many patients.
10.50 to 11.45 a. m.	Military discipline and customs of the service.
1.30 to 2.30 p. m.	Antitetanus injections; care of wounds of the face and neck associated with fractures of the maxillæ or mandible.
2.45 to 3.45 p. m.	Hospital administration; Manual for the Medical Department. Medical records and hospital administration.
3.45 to 4.30 p. m.	Drill.

6.30 to 7 a. m.	Setting-up exercises and drill.
8.30 to 9.30 a. m.	Dental supplies and materials, requisitions, transfers, vouchers, receipts.
9.40 to 10.40 a. m.	Treatment of fractured jaws; vertical and longitudinal fractures of the maxillæ.
10.50 to 11.45 a. m.	The Army Dental Corps; organization, history, status, duties.
1.30 to 2.30 p. m.	Practical instruction in first aid, hemorrhage and shock, tetanus, nutrition.
2.45 to 3.45 p. m.	Regimental and battalion aid stations; field hospitals; the battalion and regimental surgeons in trench warfare.
3.45 to 4.30 p. m.	Drill.

9.30 to 11.30 a. m.----- Clinic (conductive anesthesia and extraction), Camp Hospital No. 24.

6.30 to 7 a. m.	Setting-up exercises and drill.
8.30 to 9.30 a. m.	Property accountability and responsibility; relief from accountability in the zone of the advance.
9.40 to 10.40 a. m.	Treatment of fractured jaws; fractures of the maxillæ with little loss of substance.
10.50 to 11.45 a. m.	Army regulations; American Expeditionary Forces orders and bulletins.
1.30 to 4.30 p. m.	Gas instructions. Lecture—gas warfare, materials used and methods of use. Practical—fitting and drill with respirator and mask. Lecture—inspection of respirators and masks.

6.30 to 7 a. m.-----	Setting-up exercises and drill.
8.30 to 9.30 a. m.-----	Army Regulations; American Expeditionary Forces orders and bulletins.
9.40 to 10.40 a. m.-----	New forms and regulations for the Medical Department in American Expeditionary Forces; medical section; salvage service.
10.50 to 11.45 a. m.-----	Treatment of fractured jaws: compound, comminuted fractures with loss of substance.
1.30 to 4.30 p. m.-----	Gas instruction. Lecture—wind observations, gas alerts, and gas alarms. Practical—drills, respirators, and masks. Lecture—gas poisoning and treatment.

Wednesday, Apr. 24:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8.30 to 9.30 a. m.----- Treatment of fractured jaws; compound, comminuted fractures of the mandible.
 9.40 to 10.40 a. m.----- Special dressings and splints; demonstration of the Thomas splint.
 10.50 to 11.45 a. m.----- Army Regulations; American Expeditionary Forces orders and bulletins.
 1.30 to 4.30 p. m.----- Gas instruction.
 Lecture—gas-proof dugouts; description and use.
 Practical—drill and testing of respirators and masks with lacrymatory gas.
 Lecture—treatment of gassed patients; discussions and remarks.

Thursday, Apr. 25:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8.30 to 9.30 a. m.----- Local anesthesia.
 9.40 to 10.40 a. m.----- Dental records and reports, methods of rendering in the American Expeditionary Forces.
 10.50 to 11.45 a. m.----- Local anesthesia (continued).
 1.30 to 2.30 p. m.----- Army Regulations.
 2.45 to 3.45 p. m.----- Dental records and reports (continued).
 3.45 to 4.30 p. m.----- Drill.

Friday, Apr. 26:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8.30 to 9.30 a. m.----- Oral surgery in connection with the general surgeon.
 9.40 to 10.40 a. m.----- Army Regulations.
 10.50 to 11.45 a. m.----- Military forms and correspondence.
 1.30 to 2.30 p. m.----- Plastic operations of the face; removal of foreign bodies from the head and neck.
 2.45 to 3.45 p. m.----- General and personal hygiene.
 3.45 to 4.30 p. m.----- Drill.

Saturday, Apr. 27:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8.30 to 9.30 a. m.----- General anesthesia.
 9.40 to 10.40 a. m.----- Methods of handling wounds and fractures in the field, where medical supplies are limited.
 10.50 to 11.45 a. m.----- General anesthesia (continued).
 1.30 to 2.30 p. m.----- Practical instruction in first-aid bandaging and splinting.
 2.45 to 3.45 p. m.----- Surgical technique and assisting at operations.
 3.45 to 4.30 p. m.----- Drill.

Sunday, Apr. 28:

- 9.30 to 11.30 a. m.----- Clinic: Conductive anesthesia and extraction.

Monday, Apr. 29:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8.30 to 9.30 a. m.----- Military correspondence completed.
 9.40 to 10.40 a. m.----- Relation of oral diseases to systemic infections.
 10.50 to 11.45 a. m.----- Diseases and casualties of war.
 1.30 to 2.30 p. m.----- First-aid bandaging and dressing.
 2.45 to 3.45 p. m.----- Oral manifestations of systemic diseases.
 3.45 to 4.30 p. m.----- Drill.

Tuesday, Apr. 30:

- 6.30 to 7 a. m.----- Setting-up exercises and drill.
 8 to 9.30 a. m.----- Clinic (depressive craniotomy), at Camp Hospital No. 24.
 9.40 to 10.40 a. m.----- Military correspondence, subject completed.
 10.50 to 11.45 a. m.----- Frequency of mouth cleaning in cases of severe injuries.
 1.30 to 2.30 p. m.----- Manual for Courts-Martial and Military Law.
 2.45 to 3.45 p. m.----- Instruction in first aid, bandaging and dressing.
 3.45 to 4.30 p. m.----- Drill.

Wednesday, May 1:

6.30 to 7 a. m.-----	Setting-up exercises and drill.
8.30 to 9.30 a. m.-----	Oral manifestations of systemic diseases, completed.
9.40 to 10.40 a. m.-----	Military forms and correspondence.
10.50 to 11.45 a. m.-----	Oral hygiene, discussion at length.
1.30 to 2.30 p. m.-----	Manual for Courts-Martial and Military Law.
2.45 to 3.45 p. m.-----	Oral hygiene as applied to injured and uninjured mouths.
3.45 to 4.30 p. m.-----	Drill.

Thursday, May 2:

6.30 to 7 a. m.-----	Setting-up exercises and drill.
8.30 to 9.30 a. m.-----	Further remarks on general anesthesia.
9.40 to 10.40 a. m.-----	Methods of conducting an office practice.
10.50 to 11.45 a. m.-----	Charge to the class.
1.30 to 2.30 p. m.-----	Application of the Dental Corps to the zone of advance.
2.45 to 3.45 p. m.-----	Concluding remarks on oral hygiene and general anesthesia.

Friday, May 3:

9 a. m. to 3 p. m.-----	Completion of theses; oral examinations.
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MEDICAL INSTRUCTION FOR THE DENTAL CORPS

Reference to the programs which outline the policy of the dental section previous to July, 1918, will reveal the fact that development toward a practical field-service course had taken place, but that this development had been slow. With the seventh session, clinical instruction had been made possible. Soon after this it was possible to glean accurate information from the dental officers in divisions concerning just what their difficulties were, together with some suggestions as to the most efficient methods of solution.

With a view for amplifying the training which had already been given the student officers of the dental section, the commandant of the Army Sanitary School made the following recommendations in a letter:

ARMY SANITARY SCHOOL, ARMY SCHOOLS,
AMERICAN EXPEDITIONARY FORCES,
France, June 26, 1918.

From: The commandant, Army Sanitary School.

To: The chief surgeon, S. O. S., American Expeditionary Forces (through commandant, Army Schools).

Subject: Medical instruction of Dental Corps.

1. It is being constantly reported to the commandant of the Army Sanitary School that dental officers are being employed to do the work of medical officers not only in the back areas but in those at the front, such as battalion aid stations.

2. In order to meet the demands for knowledge of duties they would be required to perform in first-aid and in emergency, the commandant of the Army Sanitary School has provided instructors for the dental section of this school to give them an elementary knowledge of such first aid work and of the relative positions of medical units on the battle field and their functions as they might be called upon to perform in emergency.

3. As will be seen from the appended program now being followed, the following is the distribution of the time allotted to the class of the dental section:

	Hours
(a) Dental hygiene, dental diseases, and injuries affecting the practice of stomatology.....	15
(b) Anesthesia, local and general	5
(c) General instruction in gas protection and treatment of the gassed	9
(d) Purely military subjects	4
(e) Drills and setting-up exercises	13
(f) Purely medical subjects	12
(g) Administration, general knowledge of regulations, including property accountability and regulations of the Medical Department	17
Total	75

4. As this gives only 20 per cent of the time to the purely professional side of the Dental Corps and provides no opportunity, save one hour, for clinics and demonstrations on professional subjects, it is recommended that the previous recommendation some months back, to the effect that some practical demonstrations be given these officers, should be provided in the future by a tour of instruction for the purposes of practical demonstrations to the Franco-American dental center now being formed at Vichy, the division of time of the class being as follows: One week of didactic instruction in the school area and one week of practical demonstrations at Vichy.

5. That division surgeons be instructed to provide for their dental surgeons all necessary instruction in the paper work of the Army, drill and first aid, in order to thus reduce to a minimum this elementary instruction at a center like this, which should devote its time to the teaching of those things which can not be learned in a division. Inasmuch as such instruction in first aid, bandaging, etc., should be limited to that knowledge which should be possessed by all branches of the Medical Corps, it is believed that the proper person to be made responsible for such instruction should be the division surgeon and not a school devoted to the higher branches of professional work. Such instruction can be given, as it has been given for the last six months, but always at the expense of things which can not be obtained in a division and by duplication of the work of our own faculty, inasmuch as the lectures given our medical officers are too technical to be used by the dental surgeons, who, by the way, have but one-third of the time given our medical officers for instruction at this school.

6. The recommendation herein does not intend to exclude intervention of medical officers at this school in those special and necessary presentations of phases of first-aid work which they can best give; in fact, the commandant of this school desires to have at least three or four periods at his disposal for the presentation of such medical subjects; but the intention of this letter is to try to have defined the principles underlying dental instruction at this center and have time which is today taken for elementary training in military and medical subjects provided for by division surgeons, under the general head of training, instruction which can never bear fruit unless such training is continued over a period far in excess of the time which it is possible to allot to these subjects at this center, and the dental school here will be enabled to divert its energies to more important subjects and to instruction which could not be given in the division.

(Signed) BAILEY K. ASHFORD,
Colonel, Medical Corps, United States Army,
Commandant.

The results of this recommendation were later made evident in the publication of the policy of the Training Section of the General Staff concerning the dental section in the following letter:

GENERAL HEADQUARTERS,
AMERICAN EXPEDITIONARY FORCES,
France, July 20, 1918.

Memorandum for commandant, Army Schools, A. E. F.

Subject: Program of instruction, dental section, Army Sanitary School.

Examination of the program of instruction of the dental section of the Army Sanitary School and correspondence relating thereto leads to the following conclusions:

(1) The purpose of this school is to give dental surgeons attached to combat divisions or the Services of Supply instruction in preparation for field service in the American Expeditionary Forces which will supplement that given in the training camps in the United States and with troops in France.

(2) General first-aid instruction is required for all sanitary troops in divisions in France, and is given in training camps in the United States.

(3) Instruction in military law, customs of the service, Army Regulations, and general instruction in military correspondence and reports and returns is given in divisions and training camps in the United States.

(4) In view of the fact that the course for dental surgeons is short and instruction in the subject is available elsewhere, it is desired that instruction in first aid, except as it relates

to oral or dental wounds or accidents, military law, customs of the service, military correspondence, Army Regulations and reports and returns (except as changed by the American Expeditionary Forces), be discontinued in the dental section of the Army Sanitary School and the time secured used for instruction in other subjects relating to field duties of dental surgeons.

(5) There is no immediate probability of the establishment of a special-course center of oral surgery near the site of the Army Sanitary School, and until such a center is established visits of instruction for student officers of the dental section are deemed impracticable.

(Signed) H. B. FISKE,
Brigadier General, General, Staff,
Acting Chief of Staff, G-5.

FIELD SERVICE SCHOOL

It had been the aim of the director of the dental section for several months to present a course of instruction to the dental officers which would embody both the principles of dental service in the field and the consideration of the multifold auxiliary medical duties which become a part of the life of the dental officer during combat. For numerous reasons, this plan had not been practical up to October, 1918. But with the initiation of the plans for the program of the fifteenth session of the dental section of this school, a plan was considered jointly with the director of the Army Sanitary School, which contemplated the holding of 14 joint lectures of dental and medical officers, embodying practically all the essential points of medical duties and sanitary tactics which had been proven to be very important for the dental officer.

A study of the program for the fifteenth session will demonstrate the carrying out of this plan. In the first place, in order to give the dental officer some conception of the organization of the machine of which he was a part, one lecture on the organization of the entire American Expeditionary Forces was presented, and also a lecture on the organization of the Medical Department. This gave the dental officer an idea of the workings of the different sections of the general staff, of the functionings of the Services of Supply, and of the coordination of the Medical Department plans with those of the line organizations in a combat division.

Furthermore, in addition to theoretical instruction in sanitary tactics, one afternoon was devoted to practical terrain exercises, in charge of an officer who was a graduate of the General Staff College, and who had studied the divisional problem from every side.

The previous 14 sessions had contained as part of the course the preparation of a notebook, which held the different lectures in the form in which they were given. This notebook had been corrected, and was later returned to the student officer, but not until the book had been carefully studied, and the gradings given by the faculty entered upon the student's record, and made part of the official report which was made concerning him.

This notebook was a complete résumé of the student's work while at the school. But this did not give any conception of the difficulties which this man might have encountered or any questions which might have come up in his mind which it was the business of the school to answer. To the end of finding out just what problems and difficulties the student officers were confronted with, a thesis was required of each student, to be written during the first week he was at the school. This was short, 500 to 800 words, and the arrangement of the

titles was such that the student could choose the one which applied particularly to his case. For instance, there were such titles as the following: "The dental officer on duty with a division"; "The dental officer with field, evacuation, or mobile hospitals"; "The dental officer with base hospitals"; "The dental officer with detached organizations."

This thesis considered the difficulties of dental treatment, the problems of transportation, suggestions for the improvement of the particular branch of the service with which he might be connected, and furnished the faculty with the definite basis for some of their more important instruction, and gave them the opportunity of clearing up in the minds of the student officers certain of the difficulties with which they had been confronted.

After the beginning of the fifteenth session an effort was made to carry out the instruction along the lines of practical field service, with a view to helping the man with the division, who needed aid the most, and making the base hospital problem subsidiary to the larger question.

FIFTEENTH SESSION

First day:

7.20 to 7.40 a. m.	Setting-up exercises.
8.30 to 9 a. m.	Opening lecture.
9 to 10.30 a. m.	Opening remarks.
10.30 a. m. to 12 m.	Organization of the American Expeditionary Forces.
1.30 to 3 p. m.	Organization of the surgical services, American Expeditionary Forces.
3 to 4.30 p. m.	Mental hygiene.
4.30 to 5.15 p. m.	Drill.

Second day:

7.20 to 7.40 a. m.	Setting-up exercises.
8.30 to 9.30 a. m.	General orders and bulletins.
9.40 to 10.40 a. m.	The work of a dental surgeon at a base hospital.
10.50 to 11.50 a. m.	The Army Dental Corps.
1.30 to 2.30 p. m.	Fractures of the maxillæ and mandible, general considerations. Treatment of fractures of the maxillæ illustrated by records.
3 to 4.30 p. m.	Map reading.
4.30 to 5.15 p. m.	Drill.

Third day:

7.20 to 7.40 a. m.	Setting-up exercises.
8.30 to 9.30 a. m.	General orders and bulletins.
9.40 to 10.40 a. m.	Treatment of fractures of maxillæ with slight loss of substance.
10.50 a. m. to 12 m.	Map reading.
1.30 to 3 p. m.	Histopathology of war wounds.
3.30 to 4.30 p. m.	Treatment of fractures of mandible with large loss of substance.
4.30 to 5.15 p. m.	Drill.
8.30 to 10 p. m.	Shock.

Fourth day:

7.20 to 7.40 a. m.	Setting-up exercises.
8.15 to 9.15 a. m.	Hospital organization.
9.20 to 10.20 a. m.	Diseases of the oral cavity.
10.30 a. m. to 12 m.	Organization of the Medical Department.
1.30 to 3 p. m.	Organization of the Medical Department.
3 to 4.30 p. m.	General anesthesia.
4.30 to 5.15 p. m.	Drill.

Fifth day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 a. m. to 4.30 p. m. . . . Gas instruction (by gas officers in lecture room and gas chambers).

Sixth day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 a. m. to 4.30 p. m. . . . Gas instruction (by gas officers in lecture room and gas chambers).

Seventh day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 7.55 to 8.30 a. m. Clinic, Camp Hospital No. 24 (general anesthesia).
 8.30 to 9.30 a. m. Evacuation of the wounded.
 9.40 to 10.40 a. m. The regimental and battalion surgeon and battalion aid station in trench warfare.
 10.50 to 11.50 a. m. Oral manifestations of systemic diseases.
 1.30 to 2.30 p. m. Treatment of hemorrhage in connection with fractures and associated wounds.
 2.40 to 3.40 p. m. Sterilization and surgical cleanliness.
 3.50 to 4.50 p. m. Duties of the evacuation officer of an army.

Eight day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 to 9.30 a. m. Special dressings and splints.
 9.40 to 10.40 a. m. Medical records and hospital administration.
 10.50 to 11.50 a. m. Local anesthesia; consideration of the instruments and drugs.
 1.30 to 2.30 p. m. Operative technique; minor surgery.
 2.45 to 3.45 p. m. Methods of producing local anesthesia.
 3.45 to 4.30 p. m. Drill.

Ninth day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 to 9.30 a. m. Special dressings and splints.
 9.40 to 10.40 a. m. Reserve and front line sanitation.
 10.50 to 11.50 a. m. Oral hygiene as applied to uninjured mouths.
 1.30 to 2.30 p. m. Administration of dental department.
 2.45 to 3.45 p. m. Conducting a general army practice; base hospital and service of supplies.
 3.45 to 4.45 p. m. Conducting a general army practice.

Tenth day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 to 9.30 a. m. The regimental and battalion surgeon in the rest areas.
 9.40 to 10.40 a. m. Character of professional services in combat areas.
 10.50 to 11.45 a. m. Cooperation of the dental surgeon with the maxillofacial department; divisional dental surgeons; dental surgeons at field and evacuation hospitals.
 1.30 to 2.30 p. m. Problems of the battalion surgeon in war.
 2.45 to 3.45 p. m. Recent development in operative procedure as applied to army practice.
 3.45 to 4.30 p. m. Drill.

Eleventh day:

- 7.20 to 7.40 a. m. Setting-up exercises.
 8.30 to 9.30 a. m. The Thomas splint.
 9.40 to 10.40 a. m. Technique of facial plastic operations.
 10.50 to 11.50 a. m. Field sketching.
 1.30 to 2.30 p. m. Dental records and reports.
 2.45 to 3.45 p. m. Oral hygiene as applied to uninjured mouths.
 3.45 to 4.30 p. m. Drill.

Twelfth day:

- 7.20 to 7.40 a. m. ----- Setting-up exercises.
- 8.30 to 9.30 a. m. ----- Evacuation of wounded in war of movement.
- 9.40 to 10.40 a. m. ----- Anesthesia by nitrous oxide, and nitrous oxide and oxygen.
- 10.50 to 11.50 a. m. ----- The aluminum plate.
- 1.30 to 4.45 p. m. ----- Examinations.

Two clinics on conductive anesthesia, of two hours each, were held at Camp Hospital No. 24, on October 20 and 27.

Sunday afternoon, October 27, the class was given instruction in map problems.

The Army Sanitary School was closed December 31, 1918.²

REFERENCES

- (1) Memorandum from the chief of training section, G. H. Q., A. E. F., for Chief of Staff, August 27, 1917. Subject: School project for American Expeditionary Forces. (With approval by Chief of Staff, August 30, 1917.) On file, Record Room, S. G. O., 353 (Training).
- (2) Medical Department training in the American Expeditionary Forces, undated, by Col. Bailey K. Ashford. Copy on file, Historical Division, S. G. O.
- (3) G. O. No. 46, G. H. Q., A. E. F., October 10, 1917.
- (4) History of the Army Sanitary School, American Expeditionary Forces, Langres, France, undated, by Lieut. Frederick P. Hall, S. C., adjutant. On file, Historical Division, S. G. O.
- (5) Memorandum on the proposed course at the Army Sanitary School, by Col. Bailey K. Ashford, M. C., commandant, November 10, 1917. On file, Record Room, S. G. O., 353 (Training, A. E. F.).
- (6) Letter from the Surgeon General, U. S. Army, to the chief surgeon, American Expeditionary Forces, France, January 28, 1918. Subject: Coordination of training of Medical Department personnel at home and abroad. On file, Record Room, S. G. O., 353 (General).
- (7) Memorandum by Col. Bailey K. Ashford, M. C., commandant, March 29, 1918. Subject: Army Sanitary School, A. E. F. On file, Record Room, S. G. O., 352-1 (A. E. F., France) Y.
- (8) Letter from the adjutant general, general headquarters, A. E. F., to the commandant, Army Schools, March 4, 1918. Subject: Army Sanitary School. On file, Record Room, S. G. O., 352.01 (Training, A. E. F.) Y.

CHAPTER XI

COLLEGE OF MEDICAL SCIENCES,^a AMERICAN EXPEDITIONARY FORCES UNIVERSITY, BEAUNE, COTE D'OR, FRANCE

The American Expeditionary Forces University, of which the College of Medical Sciences was a department, was organized and operated under the control of the fifth section of the general staff, general headquarters, which section controlled all educational work in the American Expeditionary Forces.¹ The general plan of the university was formed in January, 1919, by the general staff officer in charge of educational subsection, G-5, and the Army educational commission of the Young Men's Christian Association. On February 8, 1919, Beaune was definitely selected as the site of the university, and work was immediately begun to organize the faculty and courses, and to plan for equipment. In February authority was issued for the establishment of the American Expeditionary Forces University, including, in the following words, the medical and other technical departments: ²

4. Since the above university opportunities are of graduate character and are therefore available only to selected men of high educational qualifications, an American Expeditionary Forces educational center will be established to provide college and technical training beyond that offered at division educational centers. Students will enroll for a period of three months. Detailed instructions for the assignment of members of the American Expeditionary Forces to this educational center will be issued from these headquarters.

The College of Medical Sciences included departments of medicine, dentistry, veterinary medicine, and pharmacy, each having a director and a corps of instructors.¹

The requirements for admission were the same as those of class A schools of corresponding character in the United States. The undergraduate courses were designed to aid the student in preparing to return to his respective school for completion of his course under the most favorable circumstances and within the shortest possible time. To this end a schedule for a complete four-year course was drawn up for each of the professional departments (medicine, dentistry, and veterinary medicine). Students who preferred to do intensive work for three months in one or two subjects, instead of securing the advantage of the three months' training in all the courses offered in the curriculum for the year to which they were eligible, were given such opportunity.

Post-graduate courses were arranged for men having the degree of doctor of medicine, which were taken in French universities at Lyon, Paris, Marseille, and Bordeaux. A course in laboratory methods and technique for post-graduate work were given at the central Medical Department laboratory at Dijon.

^a Unless otherwise indicated the statements of fact made herein are based on: History of the College of Medical Sciences, A. E. F. University, Beaune (Cote D'Or), France. Copy on file, Historical Division, S. G. O.

The facilities of the school of medical sciences included Camp Hospital No. 107, formerly Base Hospital No. 77, and Camp Hospital No. 108, formerly Base Hospital No. 97; a department of sanitation, including fifteen regimental infirmaries; and a venereal prophylaxis department.

The College of Medical Sciences, together with all the other departments of the university, was closed on June 7, 1919, and all records were turned over to the registrar.

DEPARTMENT OF MEDICINE

The faculty of this department consisted of the director and 17 commissioned assistants, two of the latter being Sanitary Corps officers, one Infantry, and one Signal Corps. The following is an outline of the course:

OUTLINE OF COURSE

ANATOMY

The course in anatomy will include gross anatomy, histology, and embryology. The work in gross anatomy will comprise three hours of didactic work per week for the first-year students. The course will be available for first-year dental students also.

The course in histology will be divided into one hour of didactic instruction and five hours of laboratory work per week. This course will be given to first-year medical, dental, pharmacy, and veterinary students.

The embryology work will include one hour of lecture and two hours of laboratory work per week. A study of human embryo and its envelopes will be taken up. Work on the early stages will be based on the chick.

BACTERIOLOGY

There will be six hours per week, two hours of lecture and four hours of laboratory work.

PATHOLOGY

The course in pathology will consist of two lecture hours and four hours of laboratory work per week.

ORGANIC AND PHYSIOLOGICAL CHEMISTRY

This course will consist of didactic instruction and four hours of laboratory work per week.

PHYSIOLOGY

The course in physiology will include two hours of didactic instruction and three hours of laboratory work. The work will be given to first-year medical, dental, and pharmacy students.

DEPARTMENT OF DENTISTRY

The dental department was organized coincidentally with the department of medicine, and the faculty consisted of the director and 10 commissioned dental officers who, besides instructing the students, were operators in the dental infirmary conducted for the benefit of all the officers and enlisted men at this post. The extent of their work may be realized from the figures that show that from March 10 to March 31, the total number of patients treated was 867 and the number of sittings totaled 1,420.

The following outline shows the subjects covered and the relationship with other departments:

COLLEGE OF DENTISTRY—OUTLINE OF COURSES

Pre dental course.—Inorganic chemistry, qualitative analysis, zoology (given in connection with courses in College of Science).

Course of first-year dental students.—Anatomy, physiology, embryology, bacteriology, histology, physiologic chemistry, organic chemistry (given in connection with courses in first-year medicine in College of Medicine).

Course for dental students.—Dental materia medica and therapeutics, operative technique, prosthetic technique, operative lectures and clinical demonstrations, prosthetic lectures and clinical demonstrations, radiography lectures and clinical demonstrations, oral surgery lectures and clinical demonstrations, local anesthesia lectures and clinical demonstrations (given at dental section of the College of Medicine).

COURSES FOR POSTGRADUATES

Selective courses suitable for graduates in dentistry were arranged in the subjects stated above, instruction being given by lectures and demonstrations.

DEPARTMENT OF VETERINARY MEDICINE

The veterinary department was first organized on a four-year basis, but after considering the lack of opportunity to give clinical instruction and advanced work, it was decided to give only first-year work, and to transfer all students of the second, third, and fourth years and postgraduate students to some foreign institution. The faculty consisted of the director and five commissioned veterinary officers. An outline of the course follows:

VETERINARY DEPARTMENT—OUTLINE OF COURSE

Veterinary physiology.—Physiology will be taught by means of lectures and recitations. The normal functions of the different systems (circulatory, respiratory, etc.), will be presented with due regard to a complete knowledge of the subjects covered. It is anticipated that the knowledge of the course will comply with the standards of veterinary colleges in the United States.

Anatomy (veterinary).—Anatomy will be taught by lectures and practical work in a laboratory, the course consisting of five hours, one hour lecture period and two laboratory periods of two hours each week. The 12 weeks' course has been divided in osteology, covering a period of 5 weeks; arthrology, covering 1 week; and myology, covering 6 weeks.

Pharmacology.—Pharmacology will be taught by a course of lectures consisting of one lecture, one hour a week, for a period of 12 weeks. The course of lectures will cover the following outline: Definition, textbook, nomenclature; pharmaceutical arithmetic; pharmaceutical operations; official preparations.

Preliminary medicine.—Preliminary medicine will consist in a course of lectures of one hour per week for 12 weeks. The course of lectures will cover the following outlines: Fundamental principles of diagnosis, 6 hours; language of medicine, 6 hours.

DEPARTMENT OF PHARMACY

The faculty of the department consisted of 7 commissioned officers, 4 of whom were of the Medical Corps; 2, Infantry; and 1, Sanitary Corps. The requirements for entrance were four years' high school or preparatory work. As given it covered only first-year subjects and included inorganic chemistry, physiology, bacteriology, histology, materia-medica, and pharmacy. Advanced students and those desiring to do postgraduate work were sent to French universities to pursue their studies.

REFERENCES

- (1) Bulletin No. 91, headquarters, American Expeditionary Forces University, Part I, The Catalogue. Beaune, Cote D'Or, France, May 16, 1919. Published by order of Colonel Reeves, president. On file, Historical Section, General Staff, G-5, Records, 144G-5 Library.
- (2) G. O. No. 30, G. H. Q., A. E. F., February 13, 1919, par. 4.

APPENDIX

APPENDIX ^a

ARMY SANITARY SCHOOL, ARMY SCHOOLS, A. E. F., FRANCE

MEMORANDUM PERTAINING TO THE APPENDED LITERATURE OF THE ARMY SANITARY SCHOOL

These documents have been carefully selected from a large number of sources and most have been prepared, translated, or abstracted personally by the staff of the school. The notes on the visit to the English front were written by the commandant from his notes, and supplement made thereto by adding data not embraced therein from the notebook of the 20 student officers forming the class.

No recommendations or résumé of these papers have been made (1) for lack of time to make it complete, and (2) because the notes themselves suggest the necessities for our Army without further burdening an already large collection of papers with additional remarks.

These documents are all confidential and are only for the use of the officers of the Army.

Care has been taken to present therein only such data as have been personally verified, as to their feasibility and correctness, by the staff of the school. An attempt is made to cover all of the essentials in the ordinary duties of the medical services of the Army.

It is believed that after its inspection an effort should be made by all receiving these documents to circulate among the officers, particularly the medical officers, the gist at least of this information, to the end that they may be advised of what is actually going on in the medical services of the French and British Armies.

BAILEY K. ASHFORD,
Colonel, M. C., United States Army,
Commandant.

Army Sanitary School No. 14.

VISIT TO THE TRENCHES—GROUP UNDER COL. BAILEY K. ASHFORD

(Majors Graham, Bryson, Watts, and Rowan)

We left the C. C. S. at 9.25 a. m. in motor ambulances for the division surgeon's office in the sector to be visited.

The type of British ambulance is about the best I have ever seen. It is as large as a van and the body is universal for the medical department. The wheels are of wire and the engines are of divers makes, Buick being preferred. Each carried two Thomas splints, some hot-water bags, and enough blankets for 4 litters, usually 12. It is heated by kerosene, and a speaking trumpet communicates with the driver from within. It is a very quiet machine.

The division surgeon was a regular officer, a lieutenant colonel. He believed—as do all these R. A. M. C. men and most of the recently appointed civilian surgeons—that mere doctors are of little use in war. The consequence was that his men were efficient, wonderfully prompt, and devoted to him. He never roared at his men, but politely flayed them when they needed it. We saw him do it. He had been in the sector only 12 days, but he already knew it well and piloted us through a perfect maze of trenches without an error.

The main dressing station.—This was practically a field hospital and could accommodate up to 150 men. It was located in a more or less damaged house and outbuildings, some of which were Nissen huts. It supplied the A. D. S. and R. A. P. There were 7 motor ambulances, 3 horse ambulances, 4 supply carts, with their limbers, etc. The horses were exceedingly well cared for and showed it. The harness was not only soft and well preserved by liberal use of saddle soap, with metal parts burnished like new, but the stables and dependencies were orderly and well whitewashed. This unit had its barber shop, saddlery shop, carpenter

^a For index list of subjects of the documents promulgated by the Army Sanitary School, A. E. F., see p 1195.—Ed.

shop, and its own canteen. There were separate dormitories, messes, baths, and latrines for the officers, noncommissioned officers, and the soldiers. The Nissen huts were excellent. They were lined with wood, well heated, well ventilated, and each held some 40 men. The beds were of iron, and the Red Cross had furnished some articles of furniture as well as games. The baths were of the "secours-aux-soldats" type. The equipment of the men was stored in a separate building, and a receipt was given to the soldier therefor. The rifle and other arms were daily oiled and cleaned. The whole place reminded one of a roadside inn near or at a pleasure resort. Whitewash had been used inside and out.

Surgery was not done here, save in great emergency. There was a ward for medical cases and one for evacuation. The wards were neat and had matting on the floor. The kitchens had grease traps to conserve the fats. We saw ablution benches, clothes driers, a lamp cleaning house, an incinerator, harness shop, and blacksmith shop. There were also dugouts for patients in case of bombardment. Usually they calculate on a stay for their patients of not over 48 hours. The discipline was perfect and the cleanliness and order of the place was remarkable. Officers showed great interest in the welfare of their men. The commanding officer was a lieutenant colonel. He kept an admission and discharge book only. Here was prepared the envelope and card worn on the clothing of the wounded or sick man.

The advance dressing station.—When the case is severe, it is sent direct to the C. C. S., but a yellow slip, giving only the date, is also sent at the same time to the M. D. S.

We now took the automobile again and proceeded to the A. D. S. There is no fixed personnel or supplies for such a station, very naturally, as where one will need 10 men another will need 40. Both advanced dressing stations, however, are manned by men of the R. A. M. C., and the A. D. S. always keeps men at the R. A. P. This station was exposed and in the cellar of a large farm building of brick which was very generally demolished by shell fire. Part of the cellar was lined with sheets of corrugated iron and banked outside with handbags. The personnel consisted of 2 officers and 28 men. Here Professor Garrod's son was killed. A narrow-gauge track connected it with the regimental aid station, near by. It was actually receiving wounded from three regimental aid stations. There were accommodations for 24 patients, but they could receive 50 in a pinch. They got their wounded generally in the early morning. All bad cases which they received went to the C. C. S., and light cases to the M. D. S. Two Thomas splints were kept here. Only first-aid surgery is done, but the dressing is if it is needed. Here the rum ration is issued for men going forward only. Some bed pans and urinals are kept on hand, as wounded men may have to be kept for some hours. The entrance to the dugout is high to avoid the worst of the gas, as it follows the surface of the ground closely. Gas-proof cabinets for dressings and food were seen. The medicines noticed were lysol, tincture of sodium nitrite, pierie acid, spirits of peppermint, ether, and camphor. Every time a man is sent to the C. C. S. by ambulance a Thomas splint is sent to replenish the stores. The men sleep upstairs over the cellar so as to have a rapid downstairs getaway to reach the cellar. Here an oxygen tank with 250 to 500 liters was found and a clover ether apparatus to administer the gas. Wheel litters were lauded and used over the road to the regimental aid station and also to the M. D. S. at night. The stock of supplies is small.

From this station we started towards W. C. by open road, the whole country being under shell fire. W. C. is a dilapidated village, all shot up, with no undamaged buildings. In the ruins of one of these was the division canteen, and hot soup and chocolate station. The canteen was always open for weary soldiers going to or coming from the trenches. Here there was an R. A. P. for the support battalion. Near this station we saw some batteries of Artillery in action. It was in a cellar, 10 feet deep, shrapnel and splinter proof, with two openings guarded by curtains. It was well whitewashed and had an oxygen tank, two Thomas splints, heated litter with blankets and accommodations for five patients. Personnel: 1 officer, 2 orderlies, 2 water-duty men, and 2 bearers. All these R. A. M. C. men stations were supplied alike with these articles, but there is a considerable variety in quality and quantity of drugs and dressings and in local conveniences, according to the medical officer in charge. This elasticity in personnel and equipment seemed convenient and sensible. All blankets and Thomas splints sent down were replaced by taking them from the ambulances. They sent wounded by litter bearers or tramway. All of these stations had wheel litters.

From this point we proceeded to the front trenches. Our route lay through excellent, well revetted, dry trenches that had duck boards; but they were by no means always deep enough to screen the head, nor were they 3 feet wide at the bottom. After a walk of about a thousand yards we reached the R. A. P. of H's regiment. The country was all tumbled up. The R. A. P. was in a cellar and was not shell proof, but was commodious, and here we saw quarters for the men. Outside was a wheel litter which was wire wheeled and had wire springs.

At this point we left for the immediate front. The scene became more and more desolate. The weather was cold, damp, and cloudy. We reached an observation point in a "strong point" which had been heavily shelled the night before. Here we looked through a sight at the German positions 200 yards away. Pretty soon we left the trench and walked to an Artillery position in a piece of ground near a ruined church. There was not much of the church left, and if we had not been told it was a church we would not have known it. After some little difficulty we climbed up into the tower, a stump of which was left, the only trace of the church, and again looked out through a slit to the German position. Returning we again found our trench and began our trip through the lines. The scene at this point was desolation itself. Not a tree or one brick on another gave a semblance of human occupancy. The ground was literally plowed up by shells. Shells and trench mortar projectiles now passed over us and we saw many of them strike. Our objective was an observation point beyond the front line and overlooked the German trenches only 30 yards away. We slipped in with the battalion officer, carefully closing the curtains behind, and from here looked into an enormous crater caused by shell bursts. We stayed in the trench and had lunch, conversing in undertones. In about 20 minutes we started to the R. A. S. at H. Street, and traversed the whole front sector, mostly in the front line or in the support trench. We met a large number of men repairing trenches after last night's affair, and passed over one place where last night many were gassed. We found the R. A. P. at H. Street located in a cellar of a ruined house. It was commodious and like the others. Here we found the water was chlorinated and treated by the method of using one and one-half scoops of bleaching powder per tank of water, an amount calculated as necessary by the Harrock apparatus. Here we saw an overhead trolley. There were two wheels on the track for each iron-expanded frame, on which hung a litter. There was a road at night for wheel litters and tramway. The medical officer had his quarters in the rear of a dispensary. Two previous officers had been American M. O. R. C.'s. There were some gas cases awaiting transportation here, I should say about eight. They were all in fairly good condition. At H. Street we found a beautiful A. D. S. Three large rooms—one for wounded, one for gas cases, which was cut off from the rest by curtains, and one for hospital personnel. They were sending these cases to M. in wheel litters and ambulances, but two ambulances were kept constantly here. There was a good kitchen, cocoa station, mess hall, etc. Here we took the machine for home at about dark.

Among the things we saw was the so-called "Helby box" for the sterilization of dressings. It was simply two tin boxes, one fitting over the mouth of the other. The upper one, perforated on two sides, corresponded to similar perforations on two sides of the inner box. The holes were placed in apposition in the sterilizer and given a 90° turn when the sterilization was completed. Beds were made of matting nailed on frames. There were separate quarters and dining room for the noncommissioned officers. The personnel of the R. A. P. was 1 officer, 1 corporal, 1 orderly, and 4 R. A. M. C. litter bearers from the A. D. S. There was a gas guard on duty at all times. A medical officer has six days in the trenches and two out.

The bucket type of latrine was used in this sector. All officers and men are well dressed clean, shaven, and comfortable, even in muddy trenches. We saw few soldiers in the fire trench, but all these were wide awake. The discipline is excellent. There is a weekly physical examination for lice.

Army Sanitary School No. 16.

LECTURES GIVEN AT THE ARMY SANITARY SCHOOL, LANGRES, FEBRUARY, 1918

By Capt. H. L. Sanford, M. R. C., Urologist, 42d Division, A. E. F.

(NOTE.—Some of the material in these lectures was taken from Circular Letter No. 28, issued by the chief surgeon of the 26th Division, for which due acknowledgment is made.)

SUMMARY

United States Army Regulations and general orders relative to venereal disease; provisions in the British and French Armies.

Venereal prophylaxis—details of technique; results secured (statistics in France); semi-monthly inspection; responsibility of company commanders and squad leaders.

Incidence of venereal disease—in the British Army; in the French Army; in United States camps.

General plan for treating venereal disease in the United States Army in France—reasons for the plan; recent experiences.

Syphilis—necessity of early diagnosis and treatment; drugs used (with demonstration); suggested standard treatment (for primary syphilis, outline furnished; for secondary, tertiary, and latent syphilis); precautions before treatment is begun; technique of novarsenobenzol injections (sterilization of instruments; preparation of patient; preparation of solution; injection; dose and contradictions; reactions to novarsenobenzol; French experience); technique of cyanide of mercury injections; general instructions to patients with syphilis after novarsenobenzol injections; inspection of patients.

Gonorrhea—general remarks on diagnosis and treatment.

Venereal sores—necessity of accurate diagnosis between syphilis and chaneroid; means used.

Chancres—methods of local treatment.

Chanroids—methods of local treatment.

Cases which should be sent a camp hospital—enumeration of complications of gonorrhea, syphilis, chanere which require hospital treatment.

Remarks on wounds and injuries of the genitourinary tract as seen at British casualty clearing stations.

LECTURE NO. 1

In civil life, the physician whose advice is sought regarding means of prevention of venereal infection gives an opinion ranging somewhere between two viewpoints. The first is that of the man who maintains that extramarital intercourse, wholly aside from moral conditions, is unnecessary and that sexual continence for the unmarried is entirely compatible with health, and should be advised. While no one will deny the moral and medical correctness of such a statement, one wonders how many of these physicians seriously expect their advice will be followed.

The other viewpoint is that of medical men who realize that the sexual instinct ranks perhaps next to that of self-preservation, and that attempts to prevent or regulate extramarital intercourse and prostitution have failed for centuries. They therefore become very pessimistic about expecting their patients to follow advice to observe sexual continence, and very frankly discuss with them means to prevent future infections. Most physicians feel, I think, that it is not within their province to discuss with the patient the moral element in the question.

When we come to consider the same question in military life, however, we find a new factor enters into the problem. A man's moral or sexual habits in private life concern no one but himself, except when he causes injury to others. The soldier, on the other hand, owes his maximum physical efficiency to the service, and any deliberate interference with that efficiency, such as may follow the disability incident to a venereal infection, is rightly held as rank an offense only slightly below a self-inflicted wound or mutilation in gravity. Although in one sense no soldier ever voluntarily becomes infected with venereal disease, still it is none the less true that at each sexual exposure he voluntarily places himself in an environment where an infection becomes possible, and as a result of which his efficiency may be impaired or lost to the service.

The Government accordingly takes the position that one way of securing physical efficiency is by advising sexual continence, and that the acquiring of a venereal infection which diminishes a man's power of service constitutes an offense for which punishment is provided. At the same time it recognizes the frailty of human nature enough to go halfway to meet the soldier who exposes himself, and offers him in a system of prophylaxis, a means of prevention of infection which if properly administered and taken in time may check the development of the disease in the vast majority of cases. Soldiers who develop infection following prophylaxis treatments are still liable to punishment, as it is considered *prima facie* evidence that the treatment was not taken in time. This is, of course, the only consistent attitude for the Government to take, as during the course of the infection it is partially or wholly deprived of the soldier's services, and it naturally can not guarantee the results of prophylaxis.

This position of the Government is outlined in detail in General Order No. 6, of July 2, 1917; General Order No. 34, of September 9, 1917; a further confidential circular to the soldiers of the United States Army, issued November 15, 1917, containing extracts from the two previous orders, and in General Order No. 77, of December 18, 1917, giving supplementary information as to the further details of carrying out the campaign against venereal disease by commanding officers and medical officers in the various units from the ports of debarkation up to the front line. Each officer should obtain copies of these orders and familiarize himself very carefully with their provisions, as many of you will later be held responsible for their proper administration.

General provisions to prevent venereal infection include:

- a. The biweekly medical inspection of all troops.
- b. Frequent lectures to troops on venereal subjects by medical officers.
- c. Provision of properly equipped prophylaxis stations at which shall be posted general orders regarding venereal disease.
- d. Inquiry as to exposure of all persons returning to camp from pass by the guard.
- e. Enforced prophylaxis for intoxicated soldiers.
- f. Interrogation of infected soldiers as to the source of infection, and withdrawal of the woman from her trade until noninfectious. The latter to be done in cooperation with the civil authorities.

g. The placing "off limits" at ports of debarkation of all houses of prostitution. At other points where troops are stationed, a certain latitude is allowed commanding officers as to measures to be adopted in this regard.

h. Landing restrictions placed on troops or members of crew, with venereal infection, of vessels or transports arriving at ports of debarkation.

i. Restrictions on the sale of alcohol to troops.

j. Provision of amusements and recreation for soldiers whenever possible.

Similar measures are adopted in the French Army, and include:

- a. Bimonthly sanitary inspection of all troops.
- b. Monthly lectures to troops on venereal diseases and their prophylaxis.
- c. A medical examination at the time of going on leave and on return from leave of each soldier.

d. Suspension of leave for all soldiers with venereal diseases.

e. Obligatory statement by the soldier of the circumstances of infection, with indication of the woman.

f. Regulation of recognized and clandestine prostitutes. The latter are under the supervision of military rather than civil authorities and measures are taken wholly without regard to private considerations.

In the English Army much the same means are used, and the subject is constantly kept before the minds of the troops by the reading of British Army regulations concerning venereal disease to all soldiers by the orderly officer at stated intervals.

Details of prophylaxis.—Certain suggestions may well be given soldiers by their medical officers in their talks to them on venereal subjects as to immediate measures to take directly after exposure, before reaching the prophylactic station.

1. Urinate at once if possible.
2. Wash penis thoroughly with soap and water; dry on clean towel.

3. Get to prophylactic station as soon as possible; certainly under three hours following exposure.

Though the actual administration of the prophylactic treatment is not done by the medical officer, he is responsible for its being given properly, and he should supervise the technique carefully until he is sure that it is being efficiently carried out by those to whom it is intrusted.

The actual technique varies somewhat, but in general principles consists of two procedures.

1. An injection of some silver salt into the urethra, which is retained for five to seven minutes before being allowed to escape.

Usually a 2 per cent protargol solution is used, made up with 15 parts of glycerine to 85 parts of water.

2. The thorough smearing of the penis with calomel ointment, preceded by careful washing with warm water and soap, and thoroughly drying; the penis is then covered with a paper napkin or toilet paper to prevent soiling the underwear.

The calomel ointment is usually made in $33\frac{1}{3}$ per cent of equal parts of lanoline, vaseline, and calomel powder.

The first measure is, of course, to prevent urethral infection with gonorrhea, the latter to guard against syphilis and chaneroid.

The urethral injection of 2 per cent protargol causes in itself a certain amount of irritation which may in some cases be mistaken for gonorrhea. It disappears in a day or two, however.

Results: One naturally asks what results experience has shown that we may expect from this method of prophylaxis.

In the first place, there are certain types of infection which we may very definitely say it will not prevent; these includes all extragenital infections, usually syphilitic, whether acquired innocently or not. Among these are chaneres of the lip or tonsil, from kissing or degenerate practices; chaneres of the face or neck from barber-shop infections; chaneres of the knuckle or other parts of the hand following bruising the hand against the teeth of a syphilitic in a fight, or surgeons' infection of the fingers during an operation or post-mortem examination. There are also the rare cases of gonorrheal ophthalmia and proctitis. Luckily these infections seldom occur, though in a series of years of private practice one may see quite a number. Apparently no one has yet thought it worth while to institute a system of oral prophylaxis to be used in connection with genital measures. There is this definite possibility of infection to be borne in mind against the occurrence of which we are taking no prophylactic measures.

On the other hand, it has been equally clearly shown that the timely and proper administration of the genital prophylactic treatment is an almost perfect prevention of genital venereal infection. As a definite proof of this I have available two sets of statistics gathered in the United States Army base hospitals in France covering the period from June 1 to December 1, 1917. In one case over 1,000 exposures were followed by not a single case of either gonorrhea or syphilis. That, indeed, is a record of which to be proud, and one which, so far as I know, has never been equaled. The other instance was that of my own unit stationed at British General Hospital No. 9, at Rouen, where in the same period of time something over 600 exposures were followed by 7 cases of gonorrhea. In none of the 7 cases, however, were we satisfied that prophylaxis was taken within three hours after exposure. One case of syphilis developed, but no prophylaxis treatment was taken. This unit was in a city of 150,000 civilian population, to which was added the constant presence of 40,000 to 60,000 British troops in training. The number of prostitutes is large, and probably a large percentage of them have been infected during the three and one-half years of the war. Though the figures in the second instance are not as good as in the first, I regard the environment of our unit as having offered a more severe test of the value of prophylaxis than in the other instance when one considers the number of troops. These statistics, which doubtless could be supported by many others were they available, are in themselves convincing evidence of the efficiency of the prophylactic system, and should instill into every medical officer who has work of this sort under his charge a feeling of confidence in it and a firm resolve to protect his troops by its careful and thorough administration.

The semimonthly inspection.—It should be borne in mind that this inspection is for the purpose not only of detecting venereal diseases but also for noting, (a) lack of cleanliness of body or clothing, (b) presence of pediculosis, scabies, lice, or infectious disease, (c) bad condition of feet and footwear.

This inspection may be carried out promptly if the men are instructed as to what is desired and the medical officer has proper assistance. When possible the man should be examined in a warm room. If this can be secured, all clothing except the trousers, drawers, and shoes should be removed and arranged for inspection. The shoes should be unlaced so that they may be taken off quickly. Each man reaches the inspecting officer with his shoes in his hands, and puts them on again as soon as they and the feet are inspected. The medical officer should sit with his back to a good light. The line of men should not be delayed for unusual cases; these should be held for later and more thorough examination. Where marks of scratching or insect bites appear, careful search should be made for pediculosis and scabies, examining also the seams of the underclothing under the arms and between the thighs. In inspection of the penis, do not neglect the region of the frenum, and palpate the inguinal glands for possible syphilitic enlargement.

Responsibility of company commanders and squad leaders.—The attention of surgeons is invited to the fact that company commanders are required to pay strict attention to the cleanliness of their men, and the police of their tents and barracks, and that paragraph 288, Army Regulations, states that chiefs of squads will be held responsible for the cleanliness of their men. In cases observed by surgeons where bodily cleanliness is being neglected, as indicated by the presence of itch or vermin, the name of the company commander or squad leader concerned should be reported to the commanding officer for proper disciplinary action with reference to the terms of the Army Regulations mentioned above.

LECTURE NO. 2

Incidence of venereal diseases among troops.—British Army: In 1912, out of an army of 107,000, the average daily number incapacitated on account of venereal disease was 593, representing a loss of over 216,000 working days a year. In 1913 the rate of incidence was 5.3 per cent per annum. In 1916 it had fallen to 2.1 per cent, due to the fact that these cases are better cared for in war than in peace. At present the British Army has so increased in size that they estimate that they lose the equivalent of 7,200,000 working days per year on account of venereal diseases.

French Army: It has been noticed that the amount of venereal infection diminishes in direct ratio the nearer the troops are to the trenches. At points of debarkation and at bases are concentrated the greatest number of prostitutes, and consequently the greater opportunities for infection. On the line of communication and behind the fighting zone, infections are more apt to occur from unorganized and clandestine sources of prostitution, shop girls, waitresses, etc. In the fighting zone, for 10 to 15 miles behind the lines almost no infections develop.

United States camps: It has been noticed that there is a low percentage of venereal infections in camps where games, amusements, and the like facilities were provided, and where temptations in near-by towns was removed as far as possible. In one camp of this sort there were less than one-half of 1 per cent of applicants for prophylaxis, while in another camp where conditions were favorable to a low standard of conduct the applications were nearly 20 per cent, about forty times as great as in the other instance.

General scheme for treating venereal infections in the United States Army.—In the British Army the men are sent down to stationary hospitals for the treatment of venereal diseases. This separates them usually some distance from their units; complicates transportation, since they travel only on certain trains under restrictions and tends to keep them out of the service longer than if they remained with their organization. In an endeavor to prevent this waste of efficiency it will be the policy of our Army—

1. To treat all uncomplicated cases of venereal disease in the infirmaries located in the immediate vicinity of the troops. (General Orders No. 34, par. 4.)
2. To treat complicated cases at camp hospitals, base hospitals, or urological hospitals, or such other hospitals as may later be designated.

The reasons for this plan are self-evident. It is hoped that it will prevent unnecessary transportation of these cases; prevent troops from getting the idea that they may escape duty at the front by acquiring venereal infection, and stops the transportation of infection to the civil population by these cases en route to the rear, as has happened in the British and French Armies. Further, under this scheme, treatment may be begun as soon as possible after the diagnosis is made, and syphilitic cases may be followed as soon as possible and as long as necessary.

Syphilis.—A method of treating syphilis has been adopted for the Army which, in simplicity of technique, the small amount of apparatus required, and time consumed in its application as well as in the efficiency of its results, seems to meet war conditions best of any methods now in use.

Diagnosis: With early diagnosis and vigorous treatment properly carried out it is now clearly established that syphilis can be cured, but both requirements are necessary for its accomplishment. In the primary lesion, smears from the sore should be taken, dried, stained, and examined at the laboratory as later described. In the later stages of syphilis, where the diagnosis is doubtful, the blood should be taken according to directions issued by the laboratories, and sent to them for a Wassermann test. If this is reported negative a provocative intravenous injection of 0.45 gm. novarsenobenzol should be given, and the blood taken again in from 12 to 24 hours afterwards for a second Wassermann test.

Drugs used (with demonstration):

- a. Novarsenobenzol in increasing doses from 0.15 to 0.90 gm.
- b. Cyanide of mercury 1 per cent solution in 1 cc. ampoules (dose 1 cc.).
- c. Intramuscular injections of mercury (usually gray oil, 40 per cent).
- d. Protiodide of mercury ($\frac{1}{2}$ gr. to $\frac{1}{3}$ gr.) by mouth.
- e. Ampoules of sterile water for dissolving the arsenobenzol.
- f. Syringes (Luer type), 3 cc. for novarsenobenzol.
- g. Syringes (Luer type), 1 c. c. for cyanide of mercury.
- h. Syringes (Barthelmy type) for gray oil (also in syringe ampoules).

Suggested standard treatment for primary syphilis. (A typewritten outline was given to each officer.)

Suggested standard treatment for secondary tertiary and latent syphilis: These cases require more thorough and prolonged treatment than primary cases.

a. (1) 6–10 injections novarsenobenzol, accompanied by (2) mercury (cyanide, intravenously; or gray oil, intravenously; or protiodide, $\frac{1}{2}$ gr. to $\frac{1}{3}$ gr. t. i. d.) by mouth.

b. Continue mercury for six weeks after the course of novarsenobenzol.

c. Repeat course of novarsenobenzol with mercury, continuing mercury for six weeks after second course as before. Stop mercury for one month and do a Wassermann test. If negative, discontinue the novarsenobenzol, but keep up the mercury for two months longer. Then after one month without treatment of any kind, take specimen of blood for Wassermann test after a provocative injection of novarsenobenzol. If negative, discontinue all treatment, but do Wassermann test every two months.

d. If either of the above Wassermann tests proves positive, give courses of 5 to 7 injections of novarsenobenzol every two or three months, with mercury continuously.

Precautions before treatment is begun with novarsenobenzol and mercury:

1. Examine urine for nephritis.
2. Examine eyes for syphilitic involvement.
3. Examine for symptoms of syphilis of central nervous system.
4. Examine for nonsyphilitic cachexia.
5. Examine heart.

6. Before injections (a) thorough catharsis, (b) no solid food at meal before injection, (c) urge drinking of water to dilute urine and take strain off kidneys in excreting novarsenobenzol.

Required for novarsenobenzol injection:

1. Luer syringe, 3 c. c.
2. Needle—should be short, with short point.
3. Tourniquet or bandage.

4. Forceps.
5. Alcohol, 95 per cent.
6. Sterile cotton.
7. Sterile gauze or towel.

Sterilization of instruments: Both syringes and needles should be boiled in clean water to avoid sediment. Syringes should be taken apart and not thrown directly into boiling water. Allow syringe to cool after boiling, before using.

Preparation of patient: The patient sits facing physician, the arm with sleeve rolled above elbow, extended across a table toward the operator. The skin over a suitable vein is cleared with alcohol, and the tourniquet applied tight enough to obstruct venous return, but not to stop arterial inflow. The patient is told to open and close his fist slowly to make the vein distend.

Preparation of solution: File and break neck of novarsenobenzol ampoule and place in a container (a cordial glass may be used), or have it held by an assistant. Break off one tip of the distilled water ampoule and place the contents of the broken ampoule into the novarsenobenzol. Shake until solution is complete. Draw the novarsenobenzol solution into the syringe through the needle, taking care not to blunt the point of the needle.

Injection: With the left thumb pull down the skin over the vein so as to steady it, and introduce the needle at an angle of 22° with the skin either directly into the vein or, if the vein is not prominent, introduce the needle, first, through the skin at the side of the vein and later by turning it toward the vein into the vein.

As soon as the needle is in the vein a small amount of blood will flow back into the syringe. When this occurs, advance the needle point slightly, release the tourniquet and inject slowly. Do not attempt to inject until you are sure the needle is in the vein. Press sterile gauze or cotton over the point of insertion of the needle as it is withdrawn, and hold the arm up for a few moments, which will prevent bleeding.

Dose and contraindications: Follow the schedule in ordinary cases, unless contraindications arise, beginning with 0.30 gm.

With syphilitic nephritis, cardiovascular lesions of the central nervous system, nervous patients, women, and small men, one should begin with 0.15 or 0.20 gm.

Contraindications to the use of novarsenobenzol are uræmia, cardiac decompensation and nonsyphilitic cachexia.

Reactions following novarsenobenzol: These are less frequent and severe than those following the larger dilutions of the drug. They are of three kinds:

1. (a) Slight elevations of temperature, lasting 6 to 24 hours; (b) nausea and vomiting; (c) diarrhea; (d) skin eruptions, with earial or scarlatini form; (e) headache; (f) conjunctivitis.

These are rarely lasting or serious, but should be carefully watched for and a second dose not given until they have entirely disappeared, and then not larger than the preceding one.

2. Immediate reactions: (a) Flushing of face, congestion of conjunctiva, fullness in throat with cough, ringing in the ears, puffiness of the face. All these are usually transient. (b) Pain across lumbar region, gradually growing worse. This may be transient or result in complete prostration, loss of consciousness, feeble pulse. This is rarely seen and rarely serious if treated immediately. Patient should be kept in lying position. Both these sets of reactions are cured by an injection of 1 c. c. of a 1 per cent solution of adrenalin chloride. This may also be used as a preventive by injection before the administration of the novarsenobenzol.

3. A more serious complication is an acute encephalitis, which may appear after the second injection, especially in cases where the first injection has been poorly borne. At times its appearance is delayed until weeks after a course of treatment. Accompanying paralysis of cranial nerves is usually transitory, but may be lasting. The French guard against assuming responsibility for any accidents which may follow the administration of novarsenobenzol by having each soldier before treatment sign the following statement.

"I respectfully request the physician in chief to admit me in order to follow a treatment with "606" and I assume all responsibility myself."

One fatality has followed the use of novarsenobenzol in one of the divisions here in France. While recognizing the value and efficiency of the drug in the treatment of syphilis, and the fact that it is borne by the great majority of patients without unpleasant results, we must always watch very carefully for signs of its poor toleration, and proceed in these cases with the greatest caution.

Injections of cyanide of mercury: A course of novarsenobenzol is well preceded by 5 to 10 injections of cyanide of mercury. The usual dose is 1 c. c., but it is well to begin with a somewhat smaller one. In cases where the novarsenobenzol is poorly borne it is wise also to reduce the dose of mercury. When its administration is followed by intestinal colic, diarrhea, and salivation it must be stopped until all symptoms have disappeared. Some form of opium is the best thing to control the colic and diarrhea.

Instructions to patients taking syphilitic treatment: (1) Bad teeth should be treated as soon as the patient is well under the influence of mercury. The dentist should be notified that the patient has syphilis. Brush teeth twice a day. (2) Wear warm clothing—avoid exposure. (3) Keep bowels well open while taking mercury. (4) Avoid alcohol, tobacco, very acid fruits.

After injections of novarsenobenzol: (1) Patients should lie down 3 to 4 hours. (2) No solid food for 3 hours; resume regular diet after 6 hours. (3) Soldiers should not be expected to report for duty during the remainder of the day on which an injection is taken.

Inspection of patients: *a.* Inspect patients the day before and the day after taking novarsenobenzol (1) for signs of reaction following injections; (2) for skin eruptions; (3) for conjunctivitis; (4) for albumen in urine, presence, increase, decrease.

b. Inspect regularly mouths of all patients taking mercury (1) for condition and care of the teeth; (2) stomatitis, swollen gums, sore or loose teeth.

Gonorrhea.—The last few years have brought little that is new to the treatment of gonorrhea—unless it has been the conviction that much more is gained by blood medicines and gentle methods than by more vigorous but misguided efforts which simply increase the irritation.

It is also difficult to inspire the average medical officer with any wild enthusiasm for the systematic following through of the treatment of a case of gonorrhea. This usual lack of interest results in half-hearted methods and low percentage of actual cures.

The proper treatment of chronic gonorrhea can not be hoped for under war conditions outside of hospitals; and as the majority of cases reach a chronic stage, the results will be poor. It will possibly be found necessary to send the unusually resistant cases to camp hospitals, together with the complicated cases, where they may find specially trained men to care for them. It is somewhat unreasonable to expect a medical officer to massage a prostate under shell fire.

If these facts are true, they simply present another strong argument for efficient prophylaxis, and medical officers in whose units this is thoroughly carried out will save themselves much later trouble.

Venereal sores.—It is often very difficult to distinguish between a soft chancre and the primary sore of syphilis. Very often a mixed infection occurs, the sore at first will present the characteristics of a chancre, and the syphilitic appearances develop later. Hence all sores should be examined for the organisms of syphilis and should not be treated as soft sores until at least three separate examinations have failed to show any evidence of syphilis.

When a venereal sore develops, careful smears should be made, dried, and sent to the laboratory with the required data. A proper smear is obtained by cleaning the sore carefully, drying it, and smearing from its base a drop of serum without the presence of too much blood. A large admixture of blood interferes with the examination of the smear and renders less probable the discovery of any syphilitic organisms.

No mercurial preparation should be used on a sore until the diagnosis is settled, as the mercury makes the detection of the syphilitic organisms very difficult. Meanwhile use on the sore the treatment advised for soft chancres.

Treatment of chancres (specific).—Local treatment consists in mercurial preparations, either calomel powder or ointments of calomel or mercury. This in connection with the constitutional treatment should cause their rapid healing.

Treatment of chancroids.—Sores which have free secretion may be treated with powders, of which thymol-iodide and iodoform are the best. In chronic dry sores, the use of powder might form a crust, damming back secretions and tending to dissemination of infection and inguinal adenitis.

Ointments of the above powders, or nonmercurial drugs, should be used. A useful form of treatment is the application of tincture of iodine to the sore. After first applying crystals or 4 per cent solution of novocaine for a few minutes, follow by an ointment dressing.

Patients should not be circumcised before sores have completely healed. The infection may be spread to the circumcision wound, or an undiagnosed syphilitic sore might be removed.

If phimosis is present, and something must be done to relieve it, a dorsal incision is sufficient.

Cases suitable to be sent to a camp hospital.—1. Syphilis: (a) All eye lesions; (b) definite involvements of the central nervous system; (c) severe nephritis.

2. Gonorrhea: (a) Severe epididymitis; (b) prostatic abscess; (c) persistent complete retention of urine; (d) suppurative inguinal adenitis; (e) endocarditis; (f) rheumatism; (g) continued fever; (h) gonorrheal ophthalmia.

3. Chaneroid: (a) Suppurating inguinal glands; (b) sores, acute or chronic, which are enlarging and not responding to treatment.

Wounds and injuries of the genitourinary tract as seen at British casualty clearing stations.—The outstanding impression which one gets from a four months' experience with wounds and injuries of the genitourinary tract at British casualty clearing stations is that the unavoidable conditions of battle, of transportation, and of military hospital management radically modify the whole treatment of this type of case and make impossible the use of what might be termed the textbook methods which would be employed under the more ideal conditions attending similar injuries in civil life. These modifications will be better understood by a short consideration of the nature of these wounds and injuries and the progress of such cases from the battle field to the casualty clearing station.

Origin: Wounds of the genitourinary tract under the present conditions of warfare are caused by bullets (rifle, machine-gun, shrapnel balls), shell fragments, bomb fragments, bayonet thrusts (rare).

Injuries most frequently seen are due to contusions following patients being found in dugouts or elsewhere or by being blown against solid structures in shell explosions. These injuries are frequently complicated by large hematomata or abscesses.

Routine progress of cases from the battle field to the casualty clearing station.—At present, in the British lines, wounded pass through the following stations in the order mentioned: (1) Regimental aid post, (2) advanced dressing station, (3) main dressing station (field ambulance), (4) casualty clearing station, (5) base hospital (or stationary hospital), (6) England.

It will be readily appreciated that under the pressure of battle conditions no attempt at finer diagnosis of the exact location of lesions is possible before the patient reaches No. 4 in the list. Hence it happens that not only all wounds of the anterior and parietal abdominal walls are classed as "penetrating abdomen" cases, but also wounds of the back, wounds of the lower chest wall where the course of the missile is evidently downward, wounds of the buttock, upper thigh, perineum, and groin, where the course of the missile is evidently upward, are also included in the same category. It is important to realize this grouping because it has a very definite influence on the disposition of the case.

Following, then, the progress of such a case, he is picked up by regimental stretcher bearers as soon as battle conditions permit, is carried to the regimental aid post, then by another set of stretcher bearers to the advanced dressing station. If the probably abdominal nature of his wound is recognized, he wastes no time in either of these first two stations, as a special effort is made to send through this class of case with the utmost speed.

The advanced dressing station, which is controlled from the main dressing station of the field ambulance, usually marks the beginning of motor transport. The patient has come thus far by hand transportation on a stretcher. Here, unfortunately, begins a portion of his journey of which the patient with this type of injury most bitterly complains. The motors have to traverse roads broken by shell holes, and with movement at night, without headlights, severe shaking of the wounded is impossible to avoid.

At the main dressing station the patient is halted only long enough to be given a field medical card on which certain particulars are set down. The antitetanic serum is given, possibly morphia, and in some instances a drink of water or thin hot soup.

From the main dressing station of the field ambulance, and now provided with his field medical card, the patient takes another smoother motor journey to the casualty clearing station. This means that cases marked "perforated abdomen" have passed through four stations, a distance of from 8 to 12 miles, occupying at least two to three hours, and generally much longer, before they finally reach the place where a very definite effort will be made to diagnose exactly and treat their condition.

The British have recently made attempts to locate hospitals near the line for the special treatment of abdominal cases in order that they might reach the operating table with as little delay as possible. Some abdominal operating has also been done at main dressing stations of field ambulances. The location of the special abdominal hospital was difficult, as it is not always possible to forecast the situation of the next "push," and the field ambulance proved to be too mobile and poorly equipped a unit to handle such cases successfully. Hence the greater part of the abdominal surgery is at present done at the casualty clearing station.

The casualty clearing station.—At the casualty clearing station the patient goes at once to the dressing room, where his wounds are examined by the surgeon on duty, who also inspects the patient's field medical card, containing a record of the opinions of the other surgeons through whose hands the case has passed, together with their treatment thus far. If the case is marked "penetrating abdomen," and the casualty clearing station surgeon agrees, the patient automatically, and without further delay, is sent to the resuscitation ward, where he is seen at once by the surgeon specialist, as the British call their head surgeons.

The resuscitation ward in the British casualty clearing station is a development of the last year or so. And many of its features and procedures have been suggested by American surgeons. It represents a definite attempt to sort out from the others the more severely wounded and to concentrate them in a ward where especial efforts may be made by stimulation, blood transfusion, and heat to combat shock and hemorrhage. This treatment is carried out by medical officers, nurses, and orderlies who do nothing else.

The resuscitation ward is the surgical city of forlorn hopes. Here the patient must prove his right to take the time and attention of a surgical team. Surgical efficiency dictates that those patients must first be worked on who seem most likely to prove paying investments by subsequent recovery.

Our cases with wounds of the genitourinary tract accordingly have now reached the resuscitation ward of a casualty clearing station. Thus far no attempt at exact diagnosis has been made, but they are here as "penetrating abdomens," with sometimes a query. In the resuscitation ward the head surgeon makes frequent rounds, noting improvement in general condition due to the resuscitation procedures; studying the patient's general condition as to fitness for operation more than the local lesion, though that too is of course considered. He speculates as to the probable course of the missile, and the injuries it would cause. In cases of through and through wounds quite exact estimates may be made.

Diagnosis: It must be realized that wounds of the urinary tract are very rarely simple uncomplicated wounds of a single organ, but occur in connection with perforations and lacerations of other adjacent structures. In certain instances perfectly definite evidence is present of injury to the urinary tract by the occurrence of hematuria or the presence or odor of urine in the wound.

In the extreme pressure of work at casualty clearing stations where these cases are operated, it has been the writer's experience, first, that they go to operation as "penetrating abdomens," with the urinary picture generally subordinated to the probable injury to other abdominal contents; and, second, that whether they are operated at all or not depends upon two factors—the length of time which has elapsed since being wounded, and their reaction to stimulation during their stay in the resuscitation ward.

Catheterization has been advised in cases of suspected perforation of the bladder or deep urethra as a routine diagnostic measure. Theoretically, this is correct, but actually, is unwise under the conditions which obtain in casualty clearing stations. Patients are moved as little as possible when in shock. They lie on the muddy stretchers on which they came; their

clothes are carefully cut off and dry blankets and heaters put over them. It is almost impossible to avoid the danger of infection in these cases. If the patient rallies enough to be fit for operation, very often, under the relaxation of anesthesia, urine is voided, and the presence or absence of blood in the urine can then be determined. Catheterization on the operating table may be done if necessary, but should always be avoided if the required information can be secured during the operation or in any other way.

Operative indications: Remembering that most of the injuries to the urinary tract are still being grouped under "penetrating abdomens" and that but few will get to the operating table with a definite diagnosis, the indications for operation will be those of the class in which they are placed.

In many casualty clearing stations, experience has taught the head surgeons arbitrarily to classify these cases as "fit" or "unfit" for operation according as to whether they reach the station within 30 hours after being wounded or subsequent to that period of time.

All cases of less than 30 hours' duration, after being "warmed up," are put on the operating table as soon as their general condition will permit. The cases of longer duration are considered *ipso facto* unfit, and are held in the resuscitation ward for observation and stimulation to prove their right to operative consideration. This is the first great general indication which, though arbitrary, has been proven by experience to be sound.

The second general consideration involves the question of surgical efficiency, and incidentally conserving man power to win the war.

With the greatest available surgical skill, the general mortality in cases of penetrating wounds of the abdomen is at least 50 per cent. Furthermore, the time consumed in these cases, involving multiple suture or extensive resection, is great. And a surgical team doing nothing but abdominal cases will perhaps perform one-third or one-half as many operations as the team taking general cases, in which the mortality will not run over 10 to 20 per cent. Accordingly it becomes a grave question whether it is good policy to employ the time of surgeons on a class of cases which takes twice the time and has twice the mortality at the expense of less severely wounded, who, if promptly operated, would show a much greater percentage of recoveries, and many of whom would return to duty. These same less severely wounded cases, on the other hand, if kept waiting too long, or if evacuated to the base without operation, often develop gas gangrene, requiring possibly amputation or resulting in death.

Although it may be a surgical triumph to operate successfully on a penetrating abdomen, it is an expensive triumph, and not surgical efficiency, until means are provided for concentrating at short notice enough surgeons at stations near the fighting to take care of everyone in "push" conditions.

Unless, then, we can isolate from the rest the uncomplicated injuries to the urinary tract, which of course show a much smaller mortality than general abdominal cases, the question of whether they will ever get to the operating table at all has in the past, at least, depended upon the considerations named.

There are also special indications urging operation. In the case of wounds involving the kidney, the diaphragm may be lacerated or the chest cavity opened. Wholly aside from the kidney indications, the respiratory balance must be restored as quickly as possible by repair of the diaphragm and by closure of "sucking" chest wounds. In these combination "chest-abdomen" cases, the indications for the restoration of the intrathoracic pressure are even more insistent than the abdominal condition. The presence of hematuria, or the absence of voiding urine for a long period with relaxed bladder, pointing to probable rupture with infiltration, are also special indications, but here too the general condition of the patient and complicating injuries influence the time of operation.

Treatment: It is impossible to do more than indicate general principles for the treatment of wounds and injuries of the genitourinary tract in war surgery for two reasons: The first is that war surgery is far from being a settled matter. An evidence of this is the fact that the English have practically had to revise their treatises on war surgery two or three times, and no one knows what will be considered the best practice six months from now. The second reason is that after the patient gets on the operating table, what the surgeon will do will depend on the patient's general condition, the length of time since he has been wounded,

and the presence of complicating wounds which may be so severe as to make the genitourinary lesion the least important feature of the case. Bearing these facts in mind then, lacerated, dirty wounds require immediate operation with complete revision and excision of damaged tissue. Penetrating or perforating bullet wounds which cause less laceration and consequently less danger of gas infection are not of so urgent a nature, and unless they are causing continued hemorrhage, or have penetrated viscera, may be more safely left for later operation.

Kidney: Kidney wounds are not seen as frequently as one might expect. In through and through bullet wounds of the kidney, unless some large artery has been affected and hemorrhage is continuing the kidney condition will be less important than the damage to adjacent organs which the missile may have caused, as, for instance, a hole in the stomach or intestine, and the kidney may well be left alone. Where large lacerated shell wounds affect the kidney, nephrectomy is the only logical treatment. If only a small portion of the organ is affected, cleaning the wound, with packing and drainage, is preferable to an attempt at section and closure. A secondary nephrectomy may be necessary later on.

Bladder: In bladder wounds two cords should be sought for; to close off the poutoneal cavity from the bladder and to prevent infiltration of urine through extra-abdominal tissues by providing for drainage for the urine, either suprapubically or by perineum. Bladder wounds are frequently caused by large shell fragments and may be complicated by puncture of the pelvis and laceration of the rectum and perineum, so that many of the cases live only a few hours after reaching the hospital. Each case must be treated as the presenting conditions demand and often tax the ingenuity of the surgeon.

Simple bullet wounds penetrating or perforating the bladder do very well and are sometimes unrecognized at the time, the bullet later being removed from the cavity of the bladder or its neighborhood. Here again the important element of the case is the question of perforation of adjacent intestine.

Urethra: Attempts at primary closure of lacerations or ruptures of the urethra are usually unsuccessful. The wound is nearly always dirty and stitches around an in-dwelling catheter usually slough, and this occurs even when the urine is sidetracked through an artificial suprapubic or perineal opening. Repair of these lacerations is much more successful when done later on after the wound has cleaned up.

Wounds of the penis, scrotum, testicles: On account of the psychic effect upon patients who become sexually mutilated as the result of war wounds, the surgeon's main object in cases of this sort should be directed toward the conservation of as much tissue as possible, even though it seems hopelessly lacerated. This lacerated tissue can later be removed if non-viable, and much of it will surprise the surgeon by reestablished circulation. Since the war the French have developed surprising ingenuity and success in their plastic reconstruction of mutilated genital organs, a result which they say has greatly contributed to sustaining the morale of these patients, who otherwise tend to become greatly depressed concerning their condition.

Army Sanitary School No. 17.

TRANSLATION OF LECTURE BY DOCTOR LEMAITRE, GIVEN AT THE ARMY SANITARY SCHOOL,
A. E. F.

CHAPTER 1

I have practiced primary suture of war wounds since the month of July, 1915. After 29 months' experience it seems interesting to publish the results I have obtained, the reasons that led me to treat war wounds in this fashion, and the technique I have used. Having had the advantage of working in an army ambulance immobilized in a large hospital center, the activity of which in a majority of cases allowed me to keep the wounded until recovery; later on in a more active center, with a capacity allowing me to keep the patient for a prolonged period, I can give these results as definite for the majority of the cases I have treated, almost all in fact, outside of fracture cases, joining their regiment directly after leaving the hospital, from 15 days to 2 months after operation and having a leave of absence varying from 15 days to 3 months. During this time, 2,283 wounded have been treated within 24 hours after their injury; the immense majority, 1,862, between the seventh hour and the fifteenth 295 before the seventh hour, and 126 after the fifteenth following their injury.

We believe it to be preferable in any large number of cases, and with multiple wounds, to speak of wounds rather than of wounded. Each one can be considered from the point of view of treatment and evolution as though it were unique. We shall, therefore, speak of wounds and not of wounded. These 2,283 wounded presented 4,227 wounds. Amongst these wounds 323 were not treated surgically on account of their small size (very small fragments, especially in the face, perforating rifle bullet wounds with entrance and exit—openings equally small, without fracture, without injury to the blood vessels or the nerves, and without any sign of infection). Of 3,904 wounds treated surgically, 2,537 were united by primary suture and 307 by secondary suture; 851 wounds were not sutured at all, either because the wounds closed progressively of themselves, because the wounded died, or, finally, because in a period of great activity wounded had to be evacuated too soon to be sutured. In our statistics we will only consider 2,537 primary sutures and we will leave aside 209 delayed primary sutures and 307 secondary sutures; also 851 wounds which were not sutured at all.

Wounds of the soft parts:

1. Wounds of the soft parts of medium importance, 718, with 3 total failures and 8 partial failures.

(NOTE.—We understand by complete failures, cases where it was necessary to remove all the stitches; and by partial failures, those where sooner or later after the operation we had to remove a few stitches, the rest remaining in place and the infection being eliminated and superficial.)

2. Wounds of the soft parts of greater importance, 106, with 12 complete failures and 19 incomplete failures.

3. Wounds of the bone without complete fracture, 148, with 5 complete failures and 4 partial ones.

4. Wounds of the soft parts with injury to a large blood vessel, 68, with 2 complete failures and 5 partial ones.

5. Wounds of the soft parts with injury to a large nerve trunk, 34, without any complete failures and 4 partial ones.

Wounds of the large joints:

1. Wounds of the tibio-tarsal (with 4 cases of astragalectomy), 15, without complete failure and 2 partial ones.

2. Wounds of the knee (with 3 immediate resections of the knee joint), 22, with 1 complete failure (cured after secondary resection).

3. Wounds of the wrist (of which 3 presented limited bone lesions of the wrist necessitating partial excision of the carpus), 19, without complete failure, but 2 partial ones.

4. Wounds of the elbow joint (of which 12 underwent partial resection), 19, without complete failure, but 3 partial ones.

5. Wounds of the shoulder joint (of which 12 were treated by immediate resection of the head of the humerus), 12, without complete failure and 1 partial failure.

Wounds of complete fracture of the bone shaft:

1. Femur, 24, without complete failure, 2 partial failures.

2. Bones of the leg, 64, with 2 complete failures.

3. Humerus, 47, with 1 failure and 3 partial ones.

4. Forearm, 26, without complete failure, 2 partial ones.

5. Clavicle, 3, without failure.

6. Ulna alone, 24, without complete failure, but with 3 partial failures.

7. Radius alone, 29, without total failure and 2 incomplete failures.

8. Fibula alone, 44, without complete failure, 5 partial failures.

9. Tibia alone, 2, with 1 complete failure.

Wounds of the hand and foot:

1. Wounds of the hand: Injury to tendons, bones, or joints, 60, with 2 complete failures.

2. Wounds of the foot with lesions of tendons, bones, or joints, 50, without complete failure and 5 partial failures.

Wounds of the skull:

1. Wounds of the skull without injury to the brain, 14, without complete failure as far as union is concerned, but with 3 deaths and 2 partial failures.

(NOTE.—One of these died from progressive meningoencephalitis. We did not suture the skull wounds when the foreign body had not been removed from the brain.)

Wounds of the chest: Penetrating wounds, 7, without fracture as far as union is concerned, but with 1 death. (Wounds of the chest walls are included in the list of wounds of the soft parts.)

It is easy to understand that it is impossible for us to study in detail each one of these cases and give a complete history. However, it seems useful, to avoid any kind of confusion, to give a few words of explanation. First of all, these statistics include two distinct periods. During the first, extending from July, 1915, to July, 1917, our service was not specialized and received all kinds of wounds, the patients not being fit for evacuation. During this period also—at least during the first six months—we were beginning to use primary suturing; and it is during this period that we had the greatest number of cases in which we did not attempt suture. Out of 851 wounds that were not sutured (mentioned above), 768 belong to this first period and 83 only to the second period. During the second period, July, 1917, to the end of December, 1917, the service was changed and received only wounds of the soft parts. It is true that, by mistake, a certain number of bone wounds, a few wounds of joints, and a few fractures have been treated. Furthermore, this service being larger than the preceding one, and the conditions in the army being relatively calm, it was possible for us to keep the wounded all the time necessary. The feeling of confidence in the technique used by us increased daily, which led us to extend primary suturing to a number of wounds, and the percentage is therefore much greater during the second period than during the first. During the first period we primarily sutured 1,046 wounds out of 2,336, a little more than 44 per cent, whereas during the second period we sutured 1,491 out of 1,891 wounds, nearly 79 per cent.

During the first period the wounds not sutured primarily subdivide as follows: Non-operated, 216, a little more than 9 per cent; delayed primary suture, or secondary suture, 306, a little more than 13 per cent; nonsutured, 768, about 32 per cent.

During the second period wounds not primarily sutured subdivided as follows: Non-operated, 107, or 5 to 6 per cent; treated by delayed primary suture, or secondary suture, 210, a little more than 11 per cent; and nonsutured, 83, or 4 to 5 per cent.

A glance at the following table shows this difference:

	First period		Second period	
	Number	Per cent	Number	Per cent
Total wounds received in hospital.....	2,336		1,891	
Nontreated surgically.....	216	9-10	107	5-6
Primary suture.....	1,046	44-45	1,491	79
Delayed primary or secondary suture.....	306	13-14	210	11-12
Nonsutured.....	768	32	83	4-5

It is extremely difficult, if not impossible, to draw conclusions from these statistics as far as the percentage of wounds that ought to be amenable to primary suture is concerned, and those that ought to be united by delayed primary suture or secondary suture, or, lastly, treated as open wounds until they spontaneously heal. For each one of these two periods corresponds to a different nature of wounds and to a different period of evolution of this surgical technique. During the first period, which includes the last six months of 1915, we sutured from 15 to 30 per cent of all wounds; during 1916 and the first six months of 1917, treating the same kind of wounded, we sutured from 55 to 60 per cent; and during the period, July, 1917, to January, 1918, we have treated almost only wounds of the soft parts. The primary sutures were almost 79 per cent, but there are three other important factors which influenced this:

1. The time elapsing between the injury and operation.
2. The feasibility of keeping the patient sufficiently long in the hospital, enabling us to discharge the patients only a few days after removing the stitches.
3. The operative capacity in relation to the number of wounded that are awaiting operation.

It is also necessary to say that the first period of our activity concerned almost exclusively wounded operated on by ourselves, whereas, during the second period, it included the wounded operated by ourselves and by our assistants working under our direction.

Lastly, we want to note the following points:

1. We do not include in these statistics wounds of the abdomen, where the abdominal wound was primarily sutured, as we consider them foreign to our subject.

2. Joint wounds, as far as primary suture is concerned, for the greater part of these joint wounds were only diagnosed during operation and the majority only concerned wounds of the capsule or the synovial membrane. It would not be fair to compare these with war wounds in general, for we have only had light cases to treat. Those with bone lesions and those where diagnosis was made before operation were treated in the service of Doctor Leriche.

3. The fractures included in our statistical report correspond mostly to the first period. They are far from representing the total number of fractures we have had to treat, and they concern the most favorable cases amongst the latter. Lastly, the statistical report only includes sutured wounds sutured because the cases were considered suitable, and we warn against the mistake it would mean to draw conclusions applying to any particular class of wounds in general.

CHAPTER 2

We think it useful to relate the phases which gradually brought us to the primary closing of wounds and thus to relate our surgical progress during the war. We must begin by stating that the circumstances were favorable. After two months of traveling—corresponding to the retreat from Belgium, the Battle of the Marne, and the beginning of the Battle of the Aisne, a period during which we had no surgical work to do—we settled in a small town a few miles from the line. There we were able to treat a certain number of gravely wounded and to follow them sufficiently to enable us to note the outcome of our treatment and what war surgery ought to be.

1. *Period of surgical expectation.*—Initially we were under the optimistic reports of the innocuous character of war missiles as far as surgery was concerned, and we were satisfied with the disinfection of entrance of the wound with tinctures of iodine, removal of the foreign bodies which were visible, and applying a good aseptic dressing. The only cases where we operated at once were vascular injuries attended by hemorrhage, great injuries necessitating amputation of the limbs, penetrating wounds of the skull or abdomen, and those injured a few days before and arriving with a fully developed infection. All other cases, after dressing, were placed under observation. In the majority of cases after 24 or 48 hours fever started, pain became more and more acute, and an abundant flow of purulent and foul fluid started and very violent inflammation became obvious. Surgery was then resorted to. Notwithstanding incisions, pus appeared in intermuscular spaces, necessitating new and frequent incisions. The general condition of the patient declined rapidly. During this period, gas gangrene, secondary hemorrhage were frequent, and in the most favorable cases suppuration persisted. The wounded man was sick for a long time and was not in condition to be transported, and very often became a cripple. This nefarious period lasted from October to the middle of November, 1914.

2. *Period of incision.*—In view of these facts we no longer dressed the wound, but operated immediately on all patients without waiting the symptoms or appearance of infection, firmly believing that their wounds were inoculated, although there were not yet any clinical signs of infection. (NOTE.—During this period we only received severe injuries, rendering evacuation of the patient by rail impossible.)

In what did this operation consist? Incision of the wounds, removal of foreign bodies (projectiles, fragments of clothing, etc.), and packing the wound with sterile gauze. This period corresponds to the first half of November and the first half of December, 1914. It marked a great improvement. But at this moment we observed in our wounds a period of suppuration, elimination of muscle, fascia, and bone splinters, attended by fever during a fortnight, this necessitated changing the dressings two or three times a week. For dressings we used exclusively sterile gauze and never irrigated the wounds.

3. *Period of wound trimming.*—We therefore thought it might be possible to do away with this elimination attended by suppuration by removal of the foreign bodies and all the tissues dead or destined to die. The operation consisted in following the projectile exactly along its track through the tissues; in removing the skin, the connective tissues, the fascia the muscle, and the bones; all that experience had taught us was doomed to elimination, provoking infection, and keeping up suppuration; ending the operation by packing with sterile gauze. This period corresponds to the second half of December, 1914, and January, 1915. A slight fever, between 37.5 and 38, lasted four or five days and very soon the wound became pink and healed normally.

4. *Fixation with iodine.*—We then understood that during the operation we reinoculated the wound surface. For this reason, trying to destroy by fixation these germs on the surface, the idea occurred to us to use tincture of iodine, the result of which for fixation of germs in the skin had for a long time been demonstrated; but in order to have fixation it is necessary that the wound should be dry, just like the skin itself. Therefore, after a complete hemostasis, we for some time used hot air to dry the wound; then we gave this practice up and merely used dry gauze firmly pressed on the wound surface, applying tincture of iodine instantly after removing the gauze. This period corresponds to the months of February, March, April, and May, 1915. We may say that it corresponded to the suppression of pus in the wound; the wound granulated and healed without suppuration and without loss of tissue.

5. *Carrel method, first technique.*—Toward the end of the month of May, 1915, we became acquainted with the method of Doctor Carrel (first technique described). During the month of June, 1915, we tried his procedure; but, probably through a mistake on our part, this technique brought back the evil days of 1914.

6. *Primary suturing.*—We, therefore, in July, 1915, definitely gave up the use of antiseptics and came back to operative surgery. Encouraged by the preceding period of four months, we began to use primary suture in war wounds, doing away with slow healing up by granulation and spontaneous formation of the scar. The results were such that gradually and rapidly we increased the number of cases where we practiced primary suture, and that in the cases where we did not try to suture immediately we placed stitches, which were tied on a few days later, thus realizing delayed primary suture. Then when we were able to keep the patient long under our direction, we practiced secondary suture in the cases where we had been unable or unwilling to close by primary or delayed primary suture. At this time we had no laboratory at our disposal, and clinical signs alone guided us as well for primary sutures as for secondary sutures. We can not here enter into the detail of the clinical signs allowing us to decide this question. This point is, furthermore, of only historical interest at present. Often when the laboratory enumeration of germs (smear) is in contradiction with the clinical information, we ask the laboratory to make a culture to decide, and generally it is the clinical information which is proved correct. We were led to insist on these successive stages of the evolution of our technique because we consider them instructive. The different moments of our technique correspond to the different phases of improvement we are obliged to go through, and they follow each other in the course of the operation in the same chronological order as in our surgical evolution. Each one of them is of essential importance before taking up the following one.

In the practice of war surgery, according to opportunity, we can stop after the first operation, or at any stage, to take up later the successive steps when opportunity presents. We can thus enumerate at once the different steps of our technique. They are:

1. Incision.
2. Following the track of the projectile and making an inventory of the lesions produced by the same.
3. Excision of the dead tissues or those destined to necrosis, including, of course, the removal of foreign bodies.
4. Hemostasis, completed by fixation of the wound by tincture of iodine.
5. Repair.

In general it is very exceptional that one is not able to carry out these different steps up to No. 4, inclusive. If, however, because of material circumstances at the moment of the operation, excision of the tissues is not completely performed at this time, one must, with curved scissors, effect their removal at a subsequent dressing to avoid their spontaneous elimination.

When all the steps of the operation excepting the last (suturing) have been performed, clinical examination helped by the laboratory indicates with precision the moment when one can close the wound, either by delayed primary or secondary suture. We insist upon this point: That war surgery has a twofold duty—first and foremost, to prevent infection; and, second, to repair carefully the disorders caused by the wound and by the operation itself.

CHAPTER 3. TECHNIQUE

1. CONDITIONS UNDER WHICH IT CAN BE CONTEMPLATED.—Before taking up the technique in detail, it seems useful to indicate briefly the conditions which make it possible.

First. An efficient surgical organization is indispensable. It is a mistake which has lasted too long to believe that a war wound, contaminated by the missile and the fragment of clothing it carries along with it, is fatally doomed to suppuration. Correctly and aseptically operated at the right moment, all war wounds, with very few exceptions, will unite as though they were aseptic. One must, therefore, give due attention to operate with as perfect aseptic technique as in ordinary practice.

Second. Sterile rubber gloves are indispensable. It is hardly necessary to say that a surgeon in an ordinary aseptic operation takes a certain pride in not soiling his gloves by contact with the wound; there is all the more reason to avoid contact with the young colonies of germs that are beginning to develop on the surface of the war wound. He must therefore operate with the tip of his instruments, forceps, scissors, and knife, and he must only use his index finger for exploring the wound in those very rare cases where he has lost the track.

Third. The assistant must do likewise, and when he holds the retractors or mops the blood from the wound he must avoid as far as possible the contamination of his gloves during the whole operation. The point on which we insist frequently is to wipe the blood by pressure without rubbing. Friction of the wound has two great drawbacks: (1) It contaminates the sterile parts of the wound; (2) it runs the risk of causing the operator to lose sight of the little track caused by the missile, which he may have a great deal of difficulty to find afterward.

Fourth. The ideal would be to set aside every instrument that has served once, and take up a fresh one. Practically, however, if those instruments which have come in contact with the parts contaminated are wiped carefully with a piece of sterile gauze at once (smooth instruments, like knives, scissors, and retractors), one can, without great risk, use the same instruments during the operation until the moment comes for suturing.

The instruments most frequently necessary are small in number and in general for each operation a box of instruments sterilized in formalin vapors at 50° C. is used and it contains 8 Kocher forceps, 6 Terrier of Pian forceps, 4 towel holders, with sharp points, 1 grooved director, 1 knife, 2 thumb forceps, a medium-sized curette, a raspatorium, 1 long forceps and 1 Rongeur forceps, 2 pairs of scissors, straight and curved. Generally the latter are of small dimensions.

When, in the course of the operation, we need supplementary instruments, we make use of a special box from which we take the necessary ones. When we come to the suturing of the wound we take the necessary instruments precisely at this moment. Each operation requires a separate set of instruments. Sterilization by means of formalin vapors has always given full satisfaction. Three boxes of instruments are necessary for every operating table working without interruption, provided an orderly is entirely devoted to preparing them. The rotation of the boxes is as follows: One box is in use in the hands of the surgeon, another is in the hands of the orderly who cleans the instruments and prepares them, and the third is in the thermostat.

We can not emphasize the fact too much that the war surgeon who wishes to succeed in primary suture must understand that it is a difficult, minute, and no brilliant task which he has to take up; but he may be convinced that his results will be in direct proportion to the care he pays in following carefully the track of the projectile; in investigating the injuries produced; in doing away with the culture media; removing minutely the foreign bodies and all the bone fragments; and in excising with great care the skin, the connective tissue, the fascia and the muscles forming what has been called the chamber of attrition. Then he will end his operation after careful hemostasis, carefully drying the wound and fixating it with tincture of iodine, by the repair of the injuries due to the wound and the surgical operation. We can affirm that in this work, more than in any other, success rewards effort.

Fifth. In general the patient requires general anesthesia, for one never knows where the wound may lead to, and local anesthesia decreases the resistance of tissues already contaminated by germs. Spinal anesthesia can be used in a number of cases.

Sixth. The most delicate point consists in following step by step the track of the projectile; it is indispensable to see very well, and the light should be so arranged that the progressively extending field of operation may be seen step by step in such a way as never to remove anything without seeing it well. A frontal mirror with electric light can render service.

Seventh. It is hardly necessary to say that the surgeon must have always present in his mind the topographical anatomy of the region he is operating on. The projectile does not follow ordinary surgical paths, and as we will have to follow it, it is a point of capital importance to always know exactly where we are working from an anatomical viewpoint. The track of the vessels and nerves must be well in mind before hand; when the wound starting far from them takes us gradually in their vicinity, very often by a quite different path than that followed in ordinary surgical operations: Projectiles take no heed of classical anatomical paths to reach an organ, and, furthermore, they often meet a bone in their path which sends them in another direction and thereby creates a new path. All of this creates difficulty, from an anatomical view point; and yet the surgeon must know how to conquer this difficulty without causing more than a minimum of damage to tissues.

This is not all. Muscles underlying each other are not necessarily at the same point of contraction at the time of the injury. At the moment of the operation, under the influence of a general anesthesia, the perforations, in each one of them do not correspond with the others. We have therefore a broken line to follow in these cases, a real difficulty for the operator. Often a matter of capital importance for the war surgeon is a knowledge of the innervation and blood supply of the muscles. We will also have to revert to this point later on.

Eighth. But let us repeat it once more; it is an absolute necessity that the surgeon should have the firm will to attain his aim.

2. INVESTIGATION BEFORE THE OPERATION.—(1) *Radioscopy*.—For a long time we operated our patients without the help of the X-ray outfit. We were thus thrown back on our own resources, to follow the missile step by step, and we can affirm that we succeeded comparatively easily in thus removing projectiles, the situation of which was unknown to us. This necessity of not losing sight of the track leads the surgeon to follow it very closely. It trains his judgment and gives him sufficient dexterity to perform easily a surgical operation which at first is not without difficulty. Thus we believe that in the immense majority of cases radioscopy examination is sufficient. It indicates about where the projectile has remained, consequently about the direction it has traveled. It indicates the size and the number, if there are several. All of this is not without interest. One entrance may lead to two projectiles in the tissues, especially when a bone has been met in its path. In this case radioscopy examination will warn the surgeon that he will have to follow a Y-shaped track, the bifurcation taking place at the point where the vulnerating agent has broken up. In other cases it will reveal the existence of a wound or fracture which had escaped clinical examination or merely been surmised.

Lastly, in the case of multiple wounds by fragments of hand grenade we have often been forced to do away completely with a radioscopy examination, operating on an aluminum table and advised only from time to time by the radiograph with his frontal screen, without however, allowing ourselves to be guided entirely by him; for here, as well as in other cases, one must follow the track of the fragment, and not, as one is too often tempted to do, go directly for the foreign body by the shortest path. This mode of doing has a twofold advantage: Firstly, it saves time, the time necessary for the radioscopy examination, and, secondly, it enables the surgeon to be constantly informed of the number and size of the projectiles that still remain to be extracted, both of which are important, if one remembers that wounded with multiple wounds are often in a condition of shock preceding their infecting, and that the operation must be always in proportion to the resistance of the wounded.

(2) *Clinical examination of the wounded*.—(a) General examination: We believe it necessary to insist on the importance of complete clinical examination of the wounded before deciding to operate. At once wounds too slight and those which we know to be rarely infected can be eliminated from the operation. Amongst the latter we can mention minute fragments

in the face and hands, without injury to the bone and tendons or the joints. For wounds of this kind, produced without the projectile having gone through the clothing, contain no fragments of cloth which are always loaded with bacteria and which are far more dangerous than the projectile itself. In the same category are included through-and-through wounds by rifle bullets when the wounds of penetration and exit are both very small, without bone, joint, vessel, or nerve injury, and the track of which is neither tympanic nor painful. One can always eliminate—but for contrary reasons—moribunds and those whose general condition contraindicates any kind of operation. It is a delicate question and it is difficult to say when and where the surgeon must take the risk and operate just the same, but he must know at once that the first contraindication to any kind of primary suture is a bad general condition. These cases do not form a part of our subject matter and we only mention them in order to emphasize the following principle: Wounded whose general condition is not satisfactory must never be primarily sutured.

The pulse must be examined. It will, far better than the temperature, enable us to foresee at once whether one will do primary suture or not. We have never sutured primarily a patient whose pulse was above 120 when he entered the hospital, and often we have done so, and with success, for others who had a rectal temperature of 38.5°.

One has attached a great deal of importance to the time elapsing between the injury and the operation; one has gone so far as to prohibit primary suture for wounded whose injury dated back more than 8 hours. In the cases related above, a large proportion was sutured more than 12 hours after the injury, certain cases 24 hours after the injury, and we are sure that in a few cases one can further increase this time. However, it remains an established fact that time is a factor of great importance in making a decision and that the percentage of cases suitable for suture decreases as the time elapses after the injury.

(b) Local examination: Local examination will also give us information.

First. It is not a long time since we have drawn the attention of surgeons to the importance of recognizing gas wounds before the operation. This can be accomplished by nail percussion (filiping) in their neighborhood and we advise strongly once more to make this examination systematically in the region surrounding the wound. Very often we will be surprised to hear a tympanic sound, and this mode of investigation alone produces this symptom tympanitis that will reach away from the entrance of the wound, far from the projectile, and far from the track. We have noticed also that this mode of investigation frequently produces exquisite pain at the point of greatest tympanitis. Research and the injuries invariably found in the course of an operation have proven to us that these tympanic wounds attended by pain always correspond to gas infection by anaerobic germs. What action must we take as far as primary suturing is concerned? We advise, at least until full information is obtained, not to suture primarily those wounds. They are, however, in the majority of cases, suitable for delayed primary suture. We must say that amongst the 2,537 cases primarily sutured, related above, there are more than 200 where we did not find this symptom before operation and where, in the course of the operation, we found and excised gelatinous infiltration of a pink color in the connective tissue, both subcutaneous and inter-muscular, and yet these wounds united without suppuration, the way an aseptic wound would have done.

Second. We must also mention the importance there is in a clinical examination to determine motor or sensory paralysis. This investigation allows us to diagnose before operation of nerve lesions which we must not forget to repair whenever it is possible.

Third. Vascular lesions, which are often overlooked, must likewise be thought of. They may influence the technique followed in the pursuit of the wound track and likewise the decision one takes at the moment of closing the wound. We may say at once that it is an absolute rule never to suture a wound underlying another one which has caused an injury leading to the ligation of the main artery, irrigating the territory first. Let it be well understood that the great risk of primary suture—gas gangrene—finds its principal factor in the existence of necrotic or badly irrigated muscles, and only a secondary factor in their contamination by anaerobic germs.

A war wound cleared of this necrotic tissue, the cells of which are copiously irrigated by oxygenated blood can be sutured. The surgeon is warned in sufficient time, by symptoms of which we shall speak later on, to remove the stitches and pack the wound without causing undue risk to the patient.

So much for the wound underlying the arterial lesions. What position must be taken as far as the wound which has caused the lesion is concerned? The factor of the general condition due to hemorrhage being eliminated, two cases must be considered: Either the limb is infiltrated with blood, tense, almost double in volume, an abundant hemorrhage having taken place in the depth and produced an internal tourniquet. In that case no suture must be attempted. It is often necessary to split widely, even to split the muscle fascia distended by this hematoma. The muscle must be freed, every source of compression removed, that would hamper its proper circulation under penalty of having it contaminated by anaerobic germs, to see it become the prey of gas gangrene prepared by the enormous decrease in its vitality and its lack of oxygen. In another case the arterial wound has caused but a little hemorrhage. It is really a dry wound. The limb is not distended. There is no diffuse hematoma. Under these conditions the wound can be sutured.

Fourth. Clinical examination will also give us information concerning muscular destruction and bone injury.

There are certain wounds of the soft parts offering such an aspect that from the start every surgeon knows that he can not—and that, even if he could, he should not—perform primary suture. The same holds true in the case of fractures.

Fifth. There are also frequent cases where the patient has multiple wounds. It is perhaps in these cases more than anywhere else that the clinician must take precedent over the surgeon. Sometimes, judging the capacity of resistance of the wounded, he will hesitate to add further shock due to the operation or he will be obliged to decide which one of the wounds claim immediate operation. In these cases he will limit himself to a careful laying open of the wound, sometimes even leaving without operation the less important injuries which he would have completely operated and sutured if they had been alone. All this the clinician can learn from examination of the wounded before taking up his instruments, but even in the course of the operation the surgeon must rectify the initial decision, deciding for or against suture according to the aspect of the lesions, which he sees in the course of the operation, although he might initially have expected to close the wound.

3. THE OPERATION ITSELF.—(1) *The incision.*—The first moment of the operation consists in incising the skin, excising at the same time the cutaneous border of the wound and the track in the subcutaneous connective down to the fascia.

But if in peace time surgical operations are always well regulated, the surgeon knowing from the start what he will have to do; it is not so in war surgery. In the first case one knows from the start the length and direction necessary for the incision and it is very exceptional that one is obliged to prolong or to deflect it in the course of the operation. In the second case, on the contrary, one does not know beforehand what lesions or infiltrations will be met in the course of the operation. For this reason with data collected by clinical examination and by radioscopic examination concerning the direction of the wound track and its depth, and also the underlying organs, we decide on a general direction more commonly parallel to the axis of the limb and the length of the incision which will initially be relatively limited.

Having immobilized the skin in a position which produces concordance between the skin wound and the track in the underlying subcutaneous tissue, we excise a small skin flap with the subcutaneous tissue, oblong in its shape, by two slightly curved incisions passing one centimeter about from the lips of the wound, and joining each other three centimeters approximately further away. Thus suture will enable us to get a linear scar.

We insist at once on the point that it is unnecessary to excise too much skin. Generally one centimeter outside of the wound is sufficient. It is, however, necessary in certain cases to be less economic in this excision. Let us repeat it, economy of tissue must be the rule of the war surgeon. No more for the skin than the muscles, must be considered, the war wound like a malignant tumor that must be taken out in one block and as extensively as possible. We can not insist too much on the fact that dead tissue must be removed and the same for tissue destined to die. But this only must be removed; and we are convinced that in the matter of removal many often having sinned by being too conservative are at present sinning in the opposite direction.

The skin and underlying adipose layer in the initial portion of the track we remove without any instrument becoming contaminated. We now have a little gap five or six centimeters in length, except in cases where a large skin wound has already obliged us to make a greater excision. However, it is exceptionally that we give it greater dimensions at the start. We prefer increasing it as the need arises, inwards or outwards, transforming it in a flap as in the course of the operation and necessity or utility arises. In this way the ultimate incision will never be greater than necessary.

(2) *Following the path of the missile.*—With a few clips of the curved scissors we remove, if necessary, a few fibers of connective tissue, expose the fascia, and we easily recognize the perforation through which the projectile has passed.

Two clips of the curved scissors, often very economical, increase this opening and remove its débris. Two Kocher forceps grasp the lips of the opening and lift in the form of a cone that already allows us to see a certain depth into the muscle the path followed by the missile. The split fascia and underlying muscle in the direction of the track allows us to see better and to bring to the surface this part of the tunnel. If bleeding occurs, it is immediately sponged. The small arteries are ligated with very fine catgut, the strands being cut very short. This can often be done by a single knot; often, even if the ligature has included some muscle tissue, we remove with the scissors the small stump thus formed.

We note the aspect of the muscle surrounding the track laid bare. One has thus a clear sight of the track through the first muscular layer. With the aid of curved scissors cutting sharply, we excise this muscle, removing only dead muscle fibers, which do not bleed, which have lost their normal color, and which do not react by fibrillary contraction under the influence of pinching with the forceps. It is well understood that we will have to remove in the course of the operation all foreign bodies and fragments of clothing found in the operation. Hemostasis is then carried out. Retractors spread the wound, and very often one sees the track of the projectile continuing in the underlying muscle. One pursues in the same way. Retractors expose to the eye and the instruments of the surgeon greater and greater depths of the wound track. Very often we have followed a projectile the size of a pea through the thigh or through the buttock down to the bone through a cutaneous opening of not more than 8 to 10 cm. and we affirm that with careful hemostasis one can complete the operation in the immense majority of cases. When we deal with a through-and-through wound, situated, for instance, in the thigh, and occupying the greatest diameter of the limb; we follow the track through one of the wounds, the one which appears to be the least traumatized; then about midway leave at this point a small gauze packing and start at the other extremity until we join the first. In a case where projectile has almost gone through the thigh, but has become lodged a few centimeters from the skin on the opposite side, we follow the track from the entrance until we reach the axis of the limb and after opening on the opposite side we go directly to the projectile until we reach the path we initially excised. This following of the track is often easy, but not always so. It is possible to lose one's way, and in this case one must avoid, above all things, to utilize the grooved director for exploration. It will merely create artefacts. It is by careful inspection of the point where the track has been lost sight of that one has the greatest chance of picking it up again. It will appear in the shape of a little blood clot or an adherent fragment of clothing, or a simple ecchymotic spot of the muscle. It is by lifting, by drawing a little sideways a few muscular fibers, that one will find one's way again. If we lose our way at the deep surface of a muscle, let us recall the physiology of the underlying muscle and see if shifting of the two muscles has not caused the formation of a broken line which we have mentioned. Let us therefore retract a little above and below the first muscle; ask the assistant to impart a few slight movements to the limb, and we will often have the agreeable surprise to see the lost trace reappear. If all this leads to nothing, let us find the nearest edge of the muscle, detach its surface from the underlying tissues and thus we will find the injury to the underlying muscle either by its new path or by taking up the first, but we will be careful not to infect the sliding surface of the two muscles, for sometimes we will discover here a few fragments of cloth that the projectile had left there and the sliding muscle had dispersed.

Sometimes things are more complicated yet. Let us suppose the case of a projectile which, instead of traveling in a perpendicular direction to the axis of the limb, has traveled

in a longitudinal direction. We begin as follows: After following the track as far as possible through a sufficiently large opening but without its being excessive, we mark the point where we stop by a little gauze mop, and then by a second incision underlying the first one we go back to this gauze mop and then continue the pursuit of the wound track. If this second opening does not allow us to reach the projectile, it is very rare that a third incision, taking us directly down to this foreign body, does not allow us by retrograde progression to find the second stopping point, thus having exposed the whole wound track. Several times we have utilized these ladder incisions and our objective has always been attained. We can not repeat too often that the track must be followed, that is must have been seen in its entirety, passing everywhere the projectile has passed, and it is one of the important factors of success in primary suture. Certainly it may succeed in other cases where the track has not been followed, for the whole extent of the track is not contaminated. We have noted that the wound track was contaminated by fragments of clothing, especially in the initial centimeters of its length and where it went through the fasciae and bone. We, therefore, sometimes, in order to avoid anatomical injuries out of proportion with the gravity of the lesion, wipe out part of the track with a sterile piece of gauze, pulled through by forceps, going exactly through the track and dragging it through in the direction supposedly followed by the projectile; but it is necessary to remember at the time of closing by suture that this slight deviation of the rule has been made, and not to forget it either, in carefully watching the patient after the operation if one has notwithstanding decided to suture primarily.

(3) *Inspection of the track; inventory of the damage done; excision.*—We have now followed the wound track completely. We have already removed all foreign bodies and bone splinters, if there were any. We have excised the cutaneous wounds. We have removed the majority of the muscle which is dead; excised when necessary; and we have investigated all the damage done.

(a) Nerve lesions will be immediately repaired, by suturing any nerve that happens to be cut. If there is only a partial wound to the nerve without complete section it is sometimes well to reinforce the union by a stitch bringing together the neurilemma. Unless there is a special indication, such as the proximity of fracture, we do not inclose the nerve in muscle or other protective tissue.

(b) Vascular injuries will be treated later on.

In the majority of cases double ligature will be necessary, taking care to place the ligature 1 cm. above the injury and to excise the injured portion of the blood vessel. It is seldom that the vessel can be sutured. However, in small lateral wounds we recommend suturing the vessel provided the neighborhood is healthy. But we know the nefarious effect of projectiles in the neighborhood, producing secondary hemorrhage, of the development of aneurism, and must therefore be very circumspect in this regard. Very often arterial lesions, even if important vessels are concerned, are disclosed only in the course of the pursuit of the wound track. They had bled very little, the perforation being momentarily and very rapidly obliterated by blood clot or reflex vasoconstriction, or in the cases of complete section by retraction of the middle tunie, become manifest in those cases when we detached the blood clot covering the opening. Often, it is possible to treat these lesions easily through the path followed, but sometimes also one meets with very great difficulties and often absolute impossibility. Therefore we always have in our service a tourniquet within reach of each operating table.

Often, also, the artery lesions are recognized at the time of the clinical examination. From the viewpoint of the technique that is to be carried out, two cases may occur. Either we consider the direction of the track will enable us to easily expose the arterial injury and we follow this path, or considering at once that this path is impossible or too risky we begin the operation by an incision which leads us directly to the artery. We treat this and primarily suture this aseptic wound. Then as though there had been no arterial injury we treat the track of the missile. When the lesion affects a large venous trunk we incise in the same way, but in such a case the tourniquet is unnecessary; compressive packing of the wound is sufficient until the ligature has been completed.

(d) *Bone injuries*.—It is necessary to remove all the splinters met. With the Rongeur forceps we must freshen the bone wound when there is only an incomplete fracture. When there is a complete fracture it is necessary to remove the splinters as completely as possible, taking particular pains to preserve the periosteum and the underlying osteo-genetic tissue, the importance of which has been so well emphasized by Doctor Leriche. It is necessary to inspect the bone marrow to remove that which is in the vicinity of the focus of the fracture but not remove the marrow extensively, as we have seen it done sometimes.

Articular bone lesions must be treated according to their importance, either by classical excision of the joint at once or by regularization of the focus of the fracture when that is possible.

We do not want to insist on this point, as it would involve lengthy explanations, and we can only repeat what has been said by Doctor Leriche on the subject.

(e) We think it is advisable, on the contrary, to insist on what must be done in the way of muscular and fascial excision.

In general the aponeurosis, which is resisting, is simply perforated by the projectile. Sometimes the tear extends a little beyond the perforation, which is always fringed by shredded tissue. These shreds must be excised for a distance of a few millimeters, but the most important thing is to inspect them carefully, for often one here finds minute fragments of clothing adhering to the tissues which are most important factors of infections. Intermuscular fascia must likewise be inspected with particular care, and we advise the removal of a little layer of muscular fibers, often healthy, which adhere to the fascia at this point in order to have a clearer sight and not allow those little fragments of clothing to escape, for they are very much to be feared. Sometimes it is necessary to inspect both faces of this tendinous layer, to split above and below the opening, and to turn out the two margins of Kocher forceps, thus exposing its deep aspect to the eyes of the surgeon. This is likewise necessary to enable one to follow the track later on.

(f) Tendons which are in the way of the projectile must likewise be minutely inspected. When they are cut they must be sutured after freshening. When suturing is impossible, they must be sutured to a neighboring tendon; in a word one must at once perform in their case the operation necessary for the best functional repair. If they have only been brushed by the projectile they must be cleansed of minute fragments of clothing which may adhere to them. Their wound must be treated the way old surgeons used to do with an amputation stump, and they must be reinforced with a catgut stitch if this treatment has increased their initial injury rendering them weak enough to jeopardize their solidity.

Sometimes, in wounds of the wrist and the ankle we have been in the necessity of dissecting, to cleanse and repair them, the extensor or flexor tendons the way we would have done for the removal of tuberculous synovitis, and thus to obtain, after primary suture, a perfect functional repair.

(g) We must not forget to excise as completely as possible this subcutaneous or intermuscular tissue infiltrated by dark blood or transformed into a kind of pink or brownish green gelatinous substance. Surgeons do not like to meet with this condition for it is often a prelude of grave infection and accompanies generally the tympanitic tracks already mentioned.

(h) Lastly, the muscles (soft tissues gorged with blood) explode very often under the influence of the impact. The asperities of the artillery projectile and especially the enormous speed which all war projectiles acquire, produce in these tissues lesions of explosion and commotion which stupefy and kill these organs which are of a relatively delicate texture. Experience has shown that grave infection occurs in war wounds, owing to a twofold factor: (1) Mortification of the muscle, which becomes an excellent culture medium in the well-regulated thermostat of the human body; (2) microorganisms are introduced by fragments of clothing carried by the missile. The first of these factors is by far the most to be feared, and the second, without the help of the first, is very often not able to produce its effect.

We must therefore remove all the necrotic portion of the muscle, but only that part that represents the culture medium. Certainly, in the beginning, the surgeon must hesitate in determining exactly what he must remove and what he must leave. Sometimes, he removes too much, sometimes he does not remove enough, and it is only his personal experience which will teach him, his judgment improving little by little, the exact line of separation between the two. It is essentially a question varying according to the nature of the case,

varying also with the nature of the wound and the depth of the track. There are some cases when any muscular excision is unnecessary. There are others where it is necessary in the extremities of the track. There are others, finally, where removing a few out febrils may be sufficient, but there are others where it will be necessary to remove considerable masses of muscle; even, in certain wounds already the prey of gas gangrene, whole muscles at a time. There are, however, certain signs which can guide the surgeon. These signs are three in number: (1) Normal coloration of the muscle; (2) bleeding of muscle, when tested by a minute clip of the scissors; (3) fibrillary contraction, when the muscle is stimulated by pinching with the forceps.

Sometimes the muscular track presents normal coloration. It is sufficient then to inspect it to remove little fragments of cloth that may exist, and to freshen it by a few scissors clips. In this case muscular excision is practically unnecessary. Very often the track is of a graying hue, even black. In such a case the superficial layer of the track must be removed. In general it is unnecessary to remove a thick layer; half a centimeter is often sufficient, sometimes less. It is rare that more be necessary, unless there is gas infection. In those cases we recommend to examine carefully the fresh section of the muscle thus produced, to see whether there is any open space between the muscular fibers, or a few cut fibers the extremity of which retracted at once after the injury may have carried with them little fragments of clothing.

Sometimes one finds the muscle paler than usual—pinkish in hue or coppery—and very often on this case the first excision, always performed with curved scissors, and about 1 cm. from the surface, offers a section which presents the same aspect.

The blood oozing on the surface similar to a pinkish dew is not to be seen. True, we can see a little blood jet from a little intramuscular artery which we have cut, but that is not the sign enabling us to say the muscle is normal. Moreover, if the muscle is stimulated by pinching slightly with the dissecting forceps it does not react by the little fibrillary contraction which is so characteristic.

What do we do in such a case? We advise splitting the fascia of the muscle about which we are in doubt, giving it breathing space and allowing it to spread out freely; then wait a few minutes, taking up another part of the wound. One will then be surprised to see this muscle, pale a few moments ago, the section of which did not bleed, that did not react when pinched by the forceps, offer now simultaneously these three symptoms. The muscle was apparently suffocated and the scissors freed the tissue, allowing it to recover life. It is really a live muscle and its excision would have been useless.

If, on the contrary, after this trial, it does not manifest its vitality we must excise it progressively, still using the curved scissors, and taking off a layer of a few millimeters at a time until the necessary characteristics appear beyond a doubt. That is precisely the reason why we repeat the quantity of muscle to be removed varies essentially according to the case, and we appeal to the tact of the surgeon, who, thanks to these symptoms, very soon acquires sufficient judgment to decide what must be removed and what can be left.

In other cases the small artery has infiltrated a muscle with blood. With a few clips of the scissors we detach the principal clots. It is often possible to leave a few dark spots resulting from this infiltration of blood without risking to compromise the primary suture.

We have already specified, but judge necessary to repeat once more, that by bleeding muscle we must not understand bleeding from a cut artery, but that little capillary oozing that appears like a pinkish dew on the whole surface of the section.

We will not insist any more on the sign of fibrillary contraction in response to stimulation by pinching. It must be constant at the proximal end of muscular fascicles which we examine, but it may fail at the distal end, depending on the condition of the nerve supply. Let it be well understood, what is important is to free the wound of all tissues whose life is finished. We must therefore leave in the wound no fragment of dead muscle and instruct our assistant not to traumatize with retractors or Kocher forceps the delicate muscular tissue, the vitality of which is easily compromised, creating one of the important factors of grave infection following war wounds.

One has doubtless noticed how much we insist on the use of curved scissors. They must cut sharply, not with their point but with their belly, cutting tangentially to the surface and for this work they are infinitely superior to the knife. The latter may prick with its point, and thus inoculate; and the stimulation it produces in the muscular fibers it cuts often causes the

underlying ones to have reflex contraction, sometimes even carrying with them into the depth of the muscle little fragments of clothing, their contaminated extremity not having been excised. We apologize for repeating once more that muscular excision must be economical, muscle may compensate and adapt itself to a new function, but it does not regenerate. Therefore, in the immense majority of cases—we would almost say in all cases—one must avoid cutting the muscles transversely. Apart from the interruption in the muscle itself, which may be restored by primary suture, one must not forget that, by so doing, one cuts as well the nerve, the blood supply of the underlying part, and the dangerous consequence is obvious. Without its being necessary to insist on the fact, it is obvious that the distal end will no longer receive its proper nerve supply, and suppression of the arterial blood jeopardizes the vitality of the distal end, being capable sometimes of causing necrosis, with formation of gas infection, and at the least causing a failure of the primary suture. For instance; we know how grave from a functional viewpoint are transfixing wounds of the calf, and yet we can affirm that if they are judiciously treated they almost always heal by primary suture. The difficulty the surgeon so frequently meets in these cases is due to a twofold cause: The blood supply of the calf muscles and the presence of the thick intramuscular aponeurosis of the soleus muscle (the large muscle bodies of the first named are irrigated almost exclusively, each one independently, by a single artery). If one of these arteries is cut, either by the projectile or in the course of the operation, the vitality of this muscular mass is so much lessened that the worst disasters may be feared and one must withhold from primary suture in all of these cases.

As to the intramuscular flat tendon of the soleus, it is situated in a deep portion of the limb, concealed by a thick layer of tissue, and the projectile often carries to this point the fragments of clothing.

One sees at once what risk would involve a wound of this region, if it were sutured without the surgeon being certain not to have left any foreign body unnoticed.

If, notwithstanding, in certain cases one feels compelled to cut a muscle crosswise, one must not do so unless one has to deal with a muscle receiving its nerve and blood supply at several points so that one can afterwards by suture restore its anatomical continuity. It is in a majority of cases preferable, if the thing be feasible, to work round the muscle, passing in that way the obstacle which it presents, and take up the track through this new path, without omitting the examination of the small portion of the track that could not be investigated by the direct path.

We admit, however, that there are cases where one must expect functional sacrifice of muscle, but at least it is a very rare exception indeed, and only to be made when cutting crosswise would involve a graver risk still. Two words can sum up what this excision of muscle tissue ought to be: No avarice; no prodigality.

(4) *Drying and fixation with tincture of iodine.*—The inventory we have made has allowed us to recognize unavoidable losses of tissue and to clear the situation. Let us now say a word in regard to repairing as well as possible without causing the patient to run any risk.

As we have said, hemostasis has been insured in the course of the operation. This hemostasis must be very thorough for two reasons: First, it must prevent the formation of hematoma, so favorable for suppuration; secondly, the wound must be completely dried so the fixation of its surface can take place under the action of tincture of iodine. We therefore completely dry each wound with gauze pressed on the wound surface and rapidly removed at the precise moment when the wound is abundantly swabbed with tincture of iodine. Immediately another dry gauze mop wipes up the excess of tincture of iodine. If the fixation has been well done, the whole wound surface becomes dry as though varnished and assumes a coppery hue which is absolutely characteristic. This procedure, if correctly carried out, is of great importance. Certainly, we do not pretend that a wound which has not been treated in this way will necessarily suppurate. Numerous facts would contradict our statement at once, and ourselves we do not resort to this mode of action in simple cases, where the pursuit of the wound track has shown us healthy tissues which require no excision, and also in superficial wounds, which are totally excised; but, on the one hand, we have already explained how we were led to this treatment, and, on the other, we believe that the small number of failures shown in our statistical report, is due partly at least to the careful carrying out of this step in the operation.

We took up tincture of iodine (5 per cent) as a fixating agent because we used it before the operation for fixation of the superficial layer of the skin before the operation and because it is a simple way of doing, and we always have this solution at hand; but we are ready to abandon it for any other fixating agent which will offer more advantages, and which will not have the drawback we are about to mention.

Tincture of iodine fixes not only the superficial microorganisms but also the underlying superficial cells of the wound. As a result a slight secretion of serum takes place, turbid, which oozes out between the stitches of the wound or along the capillary drainage when there is one, which produces no drawback, not even that of having to renew the dressing, as it drains in the deepest layer of the same. It is only necessary when capillary drainage has been used and one inspects the wound to remove this drainage on the third or fourth day. Furthermore, the slight serum elimination delays the cicatrization for four or five days. It is for this reason that we advise to remove the stitches on the 12th or even the 13th day only.

This slight drawback has a favorable consequence: It allows, when one judges it necessary, to put off the primary suture till the eighth or ninth day. We have even some cases of delayed primary suture performed on the tenth and twelfth day.

(5) *Suturing*.—As the words "primary suture," "delayed primary suture," and "secondary suture" are coming more and more into use, it is necessary to understand clearly the meaning attached to each one of them, to avoid designating the same thing by two different names. For our part, we understand by immediate primary suture the normal termination of the operation we have just described. The suture takes place immediately after the excision and treatment of the wound.

Delayed primary suture consists, without further excision or freshening of any kind, to repair the anatomical layers (when the gap in the fascia is not too great to bring them together), or the skin alone. It consists, therefore, in taking up the operation, which is at this time carried to its end, after an interruption of a variable number of days.

On the contrary, secondary suture consists in closing the wound after excision either of all the scar tissue in one mass or only an epithelial border and a narrow strip of skin in the neighborhood, and part only of the granulation tissue, when one can not do likewise.

We therefore think it advisable to distinguish two kinds of secondary suture. In one, one removes the scar tissue as a whole, and reconstructs all the layers of the flesh wound thus produced. This might be called secondary suture with anatomical reconstruction. In the other, which might be called secondary suture of the skin, one limits oneself to excision of the epithelial border, allowing the granulation tissue, entirely or in part, according to circumstances, to remain.

As far as we are concerned we always suture the wound primarily when we deem it advisable; when we do not do so, our patients are followed clinically and bacteriologically in view of delayed primary suture. When we can not perform the latter, we strive to perform secondary suture as far as possible. In these cases we prefer an anatomical repair of the wound except when it is impossible for one reason or another, and in this last case we perform a secondary suture of the skin alone.

We do not propose taking up the technique of secondary suture. The only reason we mentioned it was to emphasize the following fact: When we can not suture primarily, the treatment of the wound consists in a simple, dry aseptic dressing, without the use of any antiseptic, the dressing being renewed every five or six days. At each dressing it is necessary to make sure there are no necrotic fragments to be removed; should there be any they are detached by a snip of the curved scissors. Then we wash the skin surrounding the wound, with oleate of sodium, we dry with a gauze mop imbibed with ether, and paint the surrounding skin with a little tincture of iodine.

We can affirm that wounds treated in this way do not suppurate, or very slightly. Sometimes during a week in the interval between two dressings the wound is slightly grayish, but very soon becomes pink. In a word, when primary suture and delayed primary suture are both impossible we trust to the vital power of the patient for the disinfection of the wound—without striving to destroy the microorganisms, leaving this to the phagocytes and being very careful not to interfere with the process of autoimmunization of the patient.

Laboratory examination can be used as to the cellular and microbic condition, of the wound, more by cultures than by smears. It is the general condition of the patient, on the one hand, the aspect and evolution of the wound, on the other, and, furthermore, the absence of streptococcus that will enable us to decide when it is possible to suture.

We are convinced that treated in this way our patients are ready for secondary suture as soon as if they had been treated by the Carrel method.

It is unnecessary to describe in detail the technique of the primary suture of the wound. Suffice it to say that the different anatomical layers are repaired whenever possible and that the security can be increased by using the capillary drain, composed of three or four silkworm guts which are removed on the third or fourth day; but there are often cases where we do not place any at all.

It is useful to note that for the repair of the different layers with buried sutures, one must use nothing but fine catgut, starting from the principle that every foreign body and animal tissue favors suppuration of the wound even if it contains very few germs. For the same reasons, we cut the strands of the ligature very short and avoid strangulation of the tissues.

We end by applying dry sterile dressing and immobilizing the operated region as far as possible.

4. POSTOPERATIVE CARE OF THE PATIENT.—This is very simple. Unless there be a special indication, the dressing is changed at the end of 12 or 13 days, in order to remove the stitches when there is no capillary drainage. At the end of three or four days to remove this drainage, if one has been made; in such cases a second dressing is necessary to remove the stitches. In the great majority of cases the wound unites by first intention, and from the fifteenth to the eighteenth day no more dressing is required.

We must also mention that after the suture the mobilization of the operated region must be avoided, for, as we have already said, and as we repeat, we close wounds which are not sterile from a bacteriological point of view. Their evolution is that of a sterile wound because we have removed by operation the great factor of infection, and the defense of the organism does the rest. Nature has foresight and realizes immobilization of an infected region. We must imitate it in immobilizing the region we have operated upon. It is for this reason the results of primary suture would not be as good were one obliged to evacuate the patient and make him travel prematurely. However, this period is relatively short and taking place in the region of the wound.

We attach greater importance to the symptoms of pain. In principle, 12 hours after the operation the patient ought no longer to suffer. We don't refer, of course, to pain produced by motion or pressure on the wound. It is spontaneous pain which must call our attention, and in particular when the patient complains that the dressing is too tight. If the wounded complains, being very careful in eliminating the nervous susceptibility of the patient, we must remove the dressing. Often one discovers the cause of the complaint of the patient to be either hematoma, and stitches must be removed, the bleeding vessel sought for ligature, and the wound packed with gauze, delayed primary suture being performed two or three days later, or else we have to do with beginning infection and then all the stitches must be removed, the wound completely laid open, and packed.

This spontaneous pain is in our judgment the capital symptom to indicate that primary suture was unduly performed.

5. CONTRAINDICATIONS.—This is the most delicate point of the method. We mean discussion of the indications and contraindications to the primary suturing of war wounds.

From the start we must say that all, or almost all, war wounds which can be correctly treated in due time should be sutured as soon as possible. In other words, a suture is four or five days after the removal of the stitches the patient may travel. Many of our wounded leave the hospital, on convalescence leave, around the twentieth day, sometimes even a little earlier.

Let us now see what points deserve attention in the days that follow the operation. Three points are important—temperature, pulse, pain.

Very often there is a certain rise in temperature 38, 38.5 rectally—during the first two days, sometimes during the first three days; then rapidly the temperature falls to normal.

We must say that certain of our cases reach a temperature of 39°. This does not trouble us especially, and nothing unfavorable takes place. It is only a prolonged rise of temperature that calls for an examination of the wound. If in examining the wound there is found a little redness over one of the stitches, gentle pressure over the surrounding zone is made. If this pressure is painful, it is better to remove the stitch. If, on the contrary, pressure is painless we can leave the stitch in.

The pulse of the patient gives more precise information. In general the pulse ought to be normal, between 72 and 80. If it is more frequent, even without rise in temperature, one must watch the wound very carefully, but one need not be alarmed. More commonly, the pulse becomes rapidly normal. In the contrary case other symptoms (pain, temperature, general condition) warn the surgeon that something abnormal is indicated in all cases. We will, therefore, not speak of indications but of contraindications. These are based on manifold reasons.

Some have no relation to the patient, or the wound, or the surgeon; they are not based on technical reasons, but rather depend on the material circumstances which can not be modified. Thus, for instance, when the influx of wounded is clearly out of proportion with the limited operative capacity. Contraindications of this nature we will leave out of our discussion.

Other contraindications of a purely technical order, on the contrary, we must examine with care. We will divide them in two groups. First, absolute contraindications; second, relative contraindication.

a. Absolute contraindications.—They are the following:

First. The patient reaches the surgeon at a relatively late period after the injury. He is already suppurating or presents a zone of lymphangitis around the wound, a little streak of lymphangitis a certain distance from this, and swelling of the lymph gland in the neighborhood. We need not insist on this contraindication, which is obvious.

Second. The same applies evidently to patients who arrive, sometimes only a few hours after their wound, in our experience, but already with confirmed and extensive gas gangrene.

Third. One must in no case, excepting joint wounds (and often in this case the suture must be limited to the synovial membrane and the capsule), suture primarily a patient whose general condition is bad. But what must be understood by bad general condition? Whenever a patient is shocked, whatever may be the cause of this condition. Now, in a majority of cases of shock, except these due to hemorrhage or shock due to intoxication, the wounded should be watched and given general treatment before deciding to operate. A wounded man who is very anemic, owing to much loss of blood, whose pulse is equal to or above 120 beats a minute, emotive causes of this acceleration being eliminated, should not be primarily sutured. This is the meaning we give to the words bad general condition contraindication any primary suture.

Fourth. When one has to deal with a shattered limb, or even certain injuries of the soft parts, and one hesitates about the advisability of a primary amputation.

Fifth. We have already said that no wound underlying another wound which involves arterial injury necessitating the ligature of a vessel and a limb, ought ever to be sutured primarily.

These are the absolute contraindications, and we see that they can be reduced to two general ones: Either the wounded presents an infection too advanced to enable one to think of primary union, or else the circulation, general or local, is so impaired that by suturing the wound one would cause the patient to run the greatest risk on account of the favoring factors for the development of anaerobic germs.

b. Relative contraindications.—Let us now see what contraindications may exist in individual cases. It is here especially that the tact and clinical sense of the surgeon must guide him and where the clinician can in certain cases stop the hand of the surgeon who might be too anxious to close his wound at once.

These contraindications are numerous. Let us examine them successively.

First. The time elapsed since the injury has been noted when we examined the patient before operation. We do not attach absolute value to this factor to decide at what precise moment primary suture ought no longer to be practiced. Certain surgeons have spoken of

eight hours as being the limit. We are not of this opinion. There are cases where one must not suture primarily, even if one can operate within the first two or three hours. There are others where one can suture much later, about the twenty-fourth hour. However, the result of the study of the flora of the wounds shows in a prepotent manner that the longer time elapsed since the injury the greater becomes the importance of the microorganisms, and it is natural to take into account for final determination the time that has elapsed since the injury; but we can not and will not fix any precise moment.

Second. The same applies to the temperature taken before the operation. Initially we have never sutured any patient whose temperature was above 38. Our personal experience has taught us that one can with impunity close the wound in a patient whose temperature reaches 39, provided there be no other contraindication. These patients must be followed with special care, and the fever presented before the operation will really be of more importance in guiding the surgeon after the operation than it had at the moment of the suture itself.

Third. Does the finding of a painful, tympanitic zone around the wound before the operation, and the presence of a gelatinous and pinkish or greenish connective tissue at the time of the operation, constitute a contraindication to primary suture? When one is certain to have seen the whole of the track, to have excised all this gelatinous edema, and to have found tissues having normal characteristics of vitality. In a word, when the surgeon is well satisfied with his work the wound may be closed; but we advise being very prudent and, until one has gained experience, preferably resort to delayed primary suture in such cases.

Fourth. We have already said what we think of wounds having produced an arterial lesion, and we have mentioned that they can be sutured primarily, first, when the general condition of the patient is favorable, and, secondly, when the wound is not infiltrated by blood. When the wound is infiltrated by blood it ought not to be sutured—more with a view of preserving nutrition of the limb than from fear of infection.

Fifth. One must not suture cases where one has found in the course of the operation lesions of explosion, mortification, large quantities of clothing, not forgetting; however, that it is often possible in these cases to perform a delayed primary suture if they have been correctly operated. It is simply a question of prudence.

Sixth. When one finds in the course of the operation the whole wound track with a grayish appearance it is preferable to postpone the suture.

Seventh. When the wound is prepared with a multitude of little fragments, as frequently occurs when a hand grenade explodes in the vicinity, the vitality, if not jeopardized, is at least markedly lessened. Greater care is necessary in suturing such cases.

Eighth. When the whole wound track has not been seen, either because the guidance thread has been lost or other anatomical reasons, one has to be very circumspect. It is true that primary suture may succeed, but if it fails it is unnecessary to seek an explanation elsewhere than in this fact.

Ninth. If one is in doubt about asepsis of instruments and material used, it is obviously necessary to leave the wound open in these cases and resort to delayed primary suture.

Tenth. When the surgeon is in doubt of himself. This is a purely psychological contraindication, but it has in our eyes a capital importance and we permit ourselves to give the following advice:

Let the surgeon operate as minutely, as carefully as though he intended to perform a primary suture, but in his first operations he will only attempt the delayed suture. It is only after a certain time when he will have seen his wounded with normal temperatures, all his wounds without pus, that he will regret not having performed primary suture. Having gained confidence in himself, feeling that he has mastered infection, he will begin attempting primary suture. Thus he will avoid many disappointments.

Like the absolute contraindications these relative contraindications are based, as we have seen, on the antecedents of the wound, on the clinical examination of the patient, on the clinical examination of the wound, the anatomical condition of the lesions during the operation, the blood supply, and, lastly, the principle of general pathology which states that the same quantity of the same germ with the same degree of virulence will produce very different effects according to whether it has been inoculated in healthy, live tissues or in tissues that are dead or with decreased vitality.

RÔLE OF THE LABORATORY.—We have not mentioned so far bacteriological examination, and we have placed ourselves in the situation of a surgeon not having any laboratory at his disposal.

However, the laboratory can and must help our judgment in this matter. It is of first importance—we may say it is indispensable—for delayed primary suture and for secondary sutures. The work of Tissier has shown us how it may apply to primary sutures. In the course of a trip to La Panne in the month of March, 1917, we had the good fortune to meet him, and we remember the deep impression his opinion on streptococcus in wound infection produced upon us. This gave up the key to certain failures which we could not understand. In these cases clinical examination of the lesions found in the course of the operation had led us to perform primary suture, which we were later obliged to remove. Since then we have been able to control bacteriologically the nefarious action of the streptococcus, always in our cases of complete failure, and often in those of partial failure it was the streptococcus we found as cause of the infection.

In our partial failures where we found no streptococcus we found staphylococcus.

We, therefore, accept fully the first part of the dictum of Tissier: That every primary suture of a wound, based on correct anatomical and clinical principles, where no mistake has been made in the operation, ought to unite, and that if union fails this failure is due to streptococcus.

But basing ourselves on a practice of 30 months and the very small number of our failures, we do not for the moment consider demonstrated the fact that every wound contaminated by streptococcus is fatally doomed to suppuration and suture to failure. We can not believe that in the very large number of our primary sutures the number of streptococcus contaminations of the wound can have been so slight, and we likewise do not deem it possible that we should have eliminated from primary suture all of such cases. Continuing our present practice, we hope that laboratory investigation will soon clear up the subject.

CONCLUSION

This method is in contradiction with the general ideas accepted before the war. It was not conceived then that they could operate a wound already strongly contaminated by microbes which were developing and close it as though it were aseptic. The method has, however, no original element. It is the result of a combination of surgical acts, which are logical and have been known for a long time.

Based on observation and common sense, the method has been perfected step by step. We have often been criticized for not publishing our technique sooner, for it is now, with the exception of slight improvements, what it was two and a half years ago. Our reasons for refraining from publication are the following:

1. A technique is taught by example and not by books or words. It is understood and learned much more by seeing the surgeon act than by reading or listening to his description. Then our first publication on the subject, in the months of March, April, and May, 1916, at the Medico-Surgical Society of the ——— Army were not precisely met with encouragement, although we already had the experience of 10 months and gave the histories of 218 cases, with 2 failures. But our report was premature; ideas were not directed in this direction at that moment.

We thought there must be at the front surgeons who had been influenced by the same reasons as ourselves and were carrying out the same practice. At present this way of treating war wounds is becoming classical, and if we publish our statistics and our technique it is, on the one hand, to bring our contribution to the subject; on the other, to express our opinion on points where surgeons do not seem to be in accord in practice, if not in principle, causing the method prejudice.

Opponents of primary suture claim that it necessitates a considerable excision of tissues at the least more important than that which would be necessary for disinfection by chemical means. We are not of this opinion. Excision sufficient to make a primary suture successful is exactly equal to that which is necessary when the other method is used.

Those who excise more excise too much. Primary suture does not require to be vindicated; it does not fear the attacks of its opponents; and is capable of defending itself. The creature of French surgery will grow and extend owing to its own virtues without needing the protection of a father or an adoptive father.

Army Sanitary School No. 18.

TRIP TO THE TRENCHES—GROUP UNDER MAJOR BURNETT

Accompanied by Majors Hugo, Farris, Boswell, and Haskins, and Captain Taylor

On the morning of December 13, 1917, six medical officers left the casualty clearing station for a visit to the front-line sector, about 5 miles distant. We proceeded to the advance dressing station by ambulance; this station being located in a completely destroyed town. The advance station is in indirect command of a lieutenant colonel of the R. A. M. C., who is commanding officer of the entire field ambulance unit. The station was located in the cellar of an old demolished brewery, in which there was good protection from shell fire, in this sector practically continuous. The approach to the cellar, camouflaged and protected by two gas-proof curtains, which led into a spacious corridor, off which there were a store-room, a dressing room, a ward, an operating room, quarters for the personnel, a dining room, a laundry, a kitchen, a storeroom, and an additional waiting room for wounded, with bunks for 50 patients. Upstairs there was a bath and quarters for officers, with dining room and sleeping room. The personnel consisted of 2 medical officers, 1 American and 1 English. Additional personnel of 45 enlisted men, the bearer section entire of the field ambulance, including none commissioned officers, were on duty as dressers, litter bearers, and attendants. The supplies consisted of 3 surgical boxes, 3 medical field panniers, medical companion, surgical instruments in a sufficient quantity, changes of clothing, water tank, and a variety of splints, including the Thomas. Besides there were boxes containing various sponge basins and jars for dressings—in short, all the necessary equipment for dressing room and emergency operation purposes. There was besides a reserve supply of clothing for the personnel of the station itself. The dressing room and operating room were well equipped with an improvised operating table, with sterile dressings in glass jars, and with solution for disinfecting. No definite number of hand litters were kept at this place, but approximately 15 litters were on hand for use. The kitchen was well appointed in every way and clean. A chute is arranged into the cellar so that a loaded litter may be slid down or drawn up. The officers' quarters were clean and well protected. There was sufficient ward space, including a reserve for 135 cases to be temporarily placed if necessary. Only two ambulances were kept in front of the station, in a protected position, as experience had taught that more would result in drawing fire and consequent casualties in personnel. The function of this station was to receive wounded from the front lines; to give them proper shock treatment by external heat, and hot drinks and proper application, if not already accomplished, of the Thomas splints for suitable cases; to make a proper record for the wounded by filling out the field medical card and by entering the patient's name in admittance and discharge book for the benefit of the records of the station itself. Antitetanic serum was given at this station to all wounded, from 500 to 1,000 units being administered. Personnel was detached from this station to aid battalion medical personnel in times of "strafe." Patients are sent from there to the M. D. S. or C. C. S. as rapidly as possible, but endeavor is made to send sitting with recumbent cases. Stretcher bearers need to be very strong men. Folding litters have not proved satisfactory. This station was located about 2,500 yards in the rear of the trenches. Extreme care was used to have good protection from shell fire by means of sandbags around sides in direct line of fire. Gas curtains were kept wet with water, and the frames of dugout entrances and exit were tightly fitted. A small but excellent engine furnished electric light, but oil lamps were also installed. The station was heated by small stoves.

From this station we proceeded along a road pitted with shell holes from a gas attack of the night before, to the entrance of a communicating trench leading to the reserve and support trenches. This trench was about $1\frac{1}{4}$ miles in length, well drained, with duck-board flooring. It was wide at the top and had been severely shelled so that the parapets were in

bad condition and furnished imperfect protection. Close to and parallel to the trench was a good road, down which stretcher bearers from the trenches brought wounded by wheel litters, by hand litters, and by trolley. Apparently an understanding with the boche had successfully protected litter bearers on this road for several months, none having been fired on while carrying wounded. Instantaneous fire was drawn by any other party on this road. There were along this communicating trench three relay stations for changing of battalion litter bearers. These were slightly protected positions dug into the sides of the trench, with an outlet toward the right to the road. One noncommissioned officer, four litter bearers, and two hand litters were in each of these posts.

We passed from the communicating trench to the rear line support trench by means of another communicating trench, and here saw the first battalion aid post, designated a regimental aid post. This was near the battalion headquarters' dugout, and was itself located in a dugout directly off the support trench. We were told that the Medical Department often has to dig its own dugouts, and that they should have capacity for at least 30 recumbent patients. The entrance had a gas-proof curtain beyond which a 45° stairway led to the dugout proper; another gas curtain being placed at the foot of the stairs. This dugout had one entrance and one exit, protected in the same manner. The space was divided into living quarters for personnel, a section for the medical officer, a reception, dressing room, and ward combined, and a small accessory room in which cooking was done when cooked rations were not brought up. The lighting was by means of lanterns and candles; and the overhead protection was insufficient for direct hits by shell fire, not more than 5 feet of corrugated iron and sandbags, and timber and earth forming the roof. Those articles noted as being necessary for a regimental aid post are: Lights, operating table, litter supports, buckets, stools, gas-proof containers for stores (food and supplies), extra blankets, plenty of hot water for hot drinks and surgical use, sterilizer, instruments, ligatures, chloroform, cocaine, iodine, picric acid, sterile dressings and bandages, Thomas and other splints, including Gooch splint, adhesive plaster, plaster of Paris, instruments for emergency surgery, supply of common medicine, usually in tablet form.

No formal requisition is needed for supplies which are brought up by returning litter bearers.

The medical officer must always leave word where he is to be found. If a man is brought in who can evidently live but a short while, he is made comfortable and kept. Walking cases are dressed, given a hot drink, and are sent down. A plan of the trenches is kept here showing location of dugouts, headquarters, latrines, kitchens, and rest rooms.

The personnel consisted of one R. A. M. C. medical officer—a lieutenant, 16 stretcher bearers, 8 being actually present at the station and 8 being on duty with the companies of the battalion—2 to each company; also 1 orderly, a corporal, assistant to the surgeon, and 1 water-cart man with 4 assistants. One driver for the battalion medical cart was not present, but was on duty as a part of the organization. There were two sanitary men with each company of this battalion to look after the sanitary conditions under the direction of the medical officer of the battalion. The stretcher bearers were assigned permanently to the battalion post. The orderly was a R. A. M. C. man; the battalion cart driver was an Army Service Corps man. The equipment consisted of the personal equipment of the enlisted man, a surgical box of dressings, a field medical pannier, a medical companion, and a few additional dressings for special use. Emergency surgery of a minor nature can be carried on at this station. Additional equipment consisted of a Primus stove, a small operating table, improvised, with 8 litters, extra blankets, 4 Thomas splints, bunk racks for 8 patients, and a supply of gas masks for patients. Each stretcher bearer carried a pouch with shell dressings. A sufficient quantity of morphine in small rubber bottles was on hand. The work at this station consisted in the application of Thomas splints, temporary dressings or adjustment of dressings of all wounds; of shock treatment by warming with hot drinks and injection of morphine and of transportation of wounded through the relay stations to the advance dressing station. The records here were, first, the placing of a tally card upon the wounded, with name of the organization, rank, and any medication administered, especially morphine; also the keeping of admittance and discharge book of all sick or wounded. This was for the benefit of the records of the station itself. The medical officer should visit his sector in detail every day.

The second battalion aid post, similar in construction and personnel and function, was visited in another support trench section.

The third battalion post was located in a spacious compartment of a vast tunnel system, tunneled out of solid chalk formation. This tunnel, with its ramifications, was miles in extent and from 60 to 80 feet under the surface. Wounded and sick unable to walk were removed through this tunnel and up a shaft. The removal at the exit was accomplished by means of an overhead trolley. Ventilation of this tunnel and of the battalion post in this section was excellent. The latrines for the two first-aid posts were in a protected part of the trench, pails being used, which are daily emptied into pits 100 yards from trenches and then cleaned. All three battalion posts took particular pains in seeing that the wounded were given hot drinks, were thoroughly warmed and rested before being sent back. In times of stress there is no room for resting cases. Battalion dugouts are too small (usually about 10 feet in width and 20 to 25 feet in length) to accommodate more than 8 patients at a time. All medical officers agreed that there should be room for at least 25 or 30 cases at a time, for in battle it frequently becomes otherwise necessary to leave wounded men in the trenches outside of the dugouts. Improvised stoves burning coke were used, as little or no smoke resulted. All dugouts seen and nearly all trenches in this sector, support, and front line, were in bad state of repair, but duck boards were placed along trenches and all were well drained. Every effort was apparently made by the commanding officers to secure good personal hygiene. The drinking water was all hyperchlorited under the supervision of the water personnel of the battalion aid post. In this sector the front line fire trench was 50 yards from the German lines and stretcher bearers were continually exposed to fire, both shell and machine gun; in carrying out their work. Among the medical personnel there was everywhere a spirit of dogged and even cheerful determination to do the duty they were called upon to do. Discipline was excellent. American medical officers are apparently efficient and well liked.

The return trip was made to the advance dressing station three hours after leaving for the trenches. The commanding officer of the field ambulance, whose M. D. S. we visited, stated that additional personnel from the advance dressing station, including medical officers, was furnished battalion units whenever occasion demanded. He also stated that when an advance was made battalion medical officers did not go "over the top" until after the trenches attacked had been consolidated sufficiently to prevent a successful counterattack; that he might go over with the battalion commander, who usually did not go with his men, but that the field ambulance officer in charge of stretcher bearers usually did go over the top directly after the battalion unit. Battalion medical officers move their stations forward to the front-line trenches from the support trenches when advances are made and only take their equipment to newly consolidated trenches when there is protection in dugouts against counterattacks. Stretcher bearers from battalion units wear the symbol "S. B." in red on yellow on the arm and bring the wounded from No Man's Land to the front-line trenches. It was stated that large numbers of wounded found their own way back to the battalion post during actual battle.

The return trip to the casualty clearing station was made without incident.

ADDITIONAL NOTES

The chest for medicines is known as "the monkey." Morphine in liquid form is carried at the R. A. P., where also three Thomas splints are kept.

The trench latrines were of the pail type.

Rubber boots are provided for all men obliged to stand or work in water. Straps are furnished to prevent excoriation of the feet.

Single-wheel litters are practicable in the trench, but overhead trolley and rail at night are favorite methods of evacuation.

Two of three R. A. P.'s were poorly lighted and protected and were about 15 by 15 feet.

Daily sick call of the battalion was held at the R. A. P.

A. D. S. in brewery cellar. This is the ambulance head. Antitoxin given here and such emergency cases as can not wait an hour are here operated upon. This station only replenishes supplies at a R. A. P. in emergency. The waiting room for patients needing transportation could hold 50 patients in bunks. The personnel of this station was being

used at the time of the visit of this party to dig dugouts, under an Australian engineer. From A. D. S. men are evacuated direct to M. D. S., C. C. S., or rest station. Fourteen hundred have been handled through this station in one day.

Army Sanitary School No. 19.

TRIP TO THE TRENCHES—GROUP UNDER COLONEL WILLIAMS

Accompanied by Majors Lawrence, Wilkins, McIvor, and Bogan

This group was conducted by Lieutenant Colonel Miller, commanding the 46th Field Ambulance.

The party first proceeded to an advance dressing station, badly placed, as it was within a hundred feet of an ammunition dump, near a main road swept by machine-gun fire, and under a church tower which served as an excellent target for German shells. It was in a dugout 8 feet under the ground, and had two entrances, with gas curtains of the usual type. Patients awaiting transportation were in a large house, which was quite comfortable, near by. The station was a very comfortable one and well supplied with drugs, Thomas splints, and a kitchen from which they were serving hot coffee. The entrance was camouflaged and was protected by sandbags. There were accommodations for 24 patients in 3 tiers of litters on racks. There were warming appliances for patients and materials for stimulation, and it was well heated and lighted. The station consisted of three rooms. The dressing room was about 12 feet square; there was another room for the personnel. It was usually reached by autos, which can be sheltered behind several ruined houses. The kitchen, latrines, and waiting room were upstairs, above ground, as the dugout was improvised from a cellar. The kitchen was located directly next to a bucket latrine, and there was a dining room for the personnel. One medical officer and 8 enlisted men were in attendance here. Everything about the place was immaculate. It was 3,000 yards from the firing line.

From here the party walked across an open field to a communicating trench, and through it for about a thousand yards to a relay bearer post. These posts are for the relief of bearers coming down the trench and will accommodate 4 men and 6 patients in an emergency. From here, about 500 yards farther on, was a R. A. P. in a support trench, connected with the A. D. S. telephone. This station is about 20 feet underground. It was capable of caring for 24 patients and was adjacent to battalion headquarters. It had two exits, with the usual double gas curtains at each entrance. This post was to be abandoned shortly for another one farther front which was more commodious. Gas curtains were weighted and there was a vestibule of about 9 feet on a level, between two curtains. Curtains are soaked in solution every second day. There was some gas cases at the R. A. P. at the time. They were treated as stretcher cases and given hot coffee. There were two rooms, one a dressing room and men's quarters and one for the medical officer, 10 feet wide and 15 feet long. Drugs and dressings were few, and the latter were kept in gas-proof boxes. Supplies were kept in small quantities and frequently replaced. Two Thomas splints always on hand. There were four or more litters, blankets, appliances for heating patients, and a small stove in each room. At this station were 1 medical officer and 4 men. The wounded are carried back in the daytime by hand to the bearer post, and from there by hand to the A. D. S., where they are shipped on ambulances. At night they are taken back on the narrow-gauge railroad, if possible, as the narrow-gauge railroad parallels the communicating trench. Bearers are given a ration at the R. A. P. forward, as are combatants, but the R. A. M. C. men to the rear are not, as their work is slightly less hazardous. The latrines in the trenches are of the pail variety and their contents are buried in shell holes at night. The urinal had a splash back. The men are tagged at the R. A. P. and the A. D. S. starts the white "field medical card" carried on the buttonhole in a brown envelope. The battalion water system was under the supervision of a noncommissioned officer and 4 men, who had no other duties.

The latrines left the communicating trench at right angles and were approached by a gallery about 6 paces long, which turned to the right 4 paces and then to the left about the same distance. The pails were disinfected by 5 per cent cresol and were at all times fly proof.

The fuel used up here was coke, which was burned in an improvised stove made of an oil drum.

Sanitation in the trenches seemed very satisfactory. There was no rubbish on the ground, the water was chlorinated, and all garbage was buried in the same manner as feces, in shell holes at night.

The party now passed through a tunnel to the first-line trench, situated 50 yards from the German line. This tunnel was about a thousand yards long, was equipped with electric light, and men were quartered on all sides. Kitchens were found in the tunnel. A section of this trench had been blown in the previous night. There was a small tramway running the entire length, and there were carpenter shops, electrical shops, ammunition stores, quarter-master storerooms, etc. The material removed during the excavation of this tunnel was used to fill sandbags. The tunnel was well warmed. It was noticeable that the trenches were kept clean and in good repair, men being at work upon them constantly. Trench duck boards were installed everywhere. The drainage was excellent, and everything had the appearance of being absolutely clean. The water supply in the trenches was by cart, and it was also piped to battalion headquarters. Antitetanic serum is given at the A. D. S., where the white card giving the history of the patient, to be fastened to his buttonhole, is begun. Men at the front are examined weekly for contagious diseases and lice.

When a new medical officer takes over a station he goes up the day before to check up and sign for the property. He also acquaints himself with the sector he is serving and is given instructions as to water, sanitation, etc.

Trench foot is not so prevalent now as heretofore, owing to the severe disciplinary measures taken. Clean socks come up nightly with the rations. Dry boots are supplied, and whale oil is rubbed into the feet by groups of two, one man massaging the other's feet.

A gas guard of two men is kept on duty at all times, and a Klaxon horn is used for gas signal.

During an attack the medical officer is moved to the front-line trenches and the medical officer at the A. D. S. comes up to the R. A. P. The M. O. of the regiment is in constant touch with the C. O. and goes over the top with him in the third or fourth wave. Listening posts were shown and apparatus for detecting the direction and velocity of the wind explained.

From this place the party returned to the A. D. S., passing a bearer relay post en route, where the personnel had made very comfortable living quarters. At the A. D. S. was a British cemetery, each grave being marked where possible. Here there were dugouts for gas cases, protected by double doors, and the blankets were soaked every third day. Latrines of the bucket type and emptied into a pit every night. Stoves were improvised. At this post two ambulances were on duty, and here the surgeon told us that he believed that every R. A. P. should have accommodations for 30 patients.

From here the party proceeded to the M. D. S., located in a very old building, with dressing room, operating room, and all the equipment of a tent section. A ward for officers, noncommissioned officers, and soldiers, dining rooms for same, kitchen, and latrines of the bucket type; canteen, baths, saddlery, tailor shop, harness-maker shop, and a beautifully kept animal corral, with a transportation park near by. All leather goods were in perfect condition and clean, and the metal parts were well polished. There was a Thresh disinfector, and they were told that by working from 9 a. m. to 9 p. m. they could sterilize a thousand blankets, and that the cost of the machine is \$3,500. The storeroom, carpenter shop, and other dependent buildings were also seen. The operating room was equipped for performing operations of a major character. While arrangements had been made for earing for the patients 48 hours, they were passed to the C. C. S. before that time, as a rule. There was a good drying room for clothing and an office.

GENERAL REMARKS ON THE TRENCHES

The water used was from an artesian well and was pumped up, even to the fire trench, but it was also carried in water carts on narrow-gauge railroad.

Latrines were of both bucket and deep-trench type, but the latter was preferred.

In all gas cases the clothing was immediately removed and new clothing supplied.

The duck boards had a clear space of from 9 inches to 2 feet under them at all places allowing drainage. No broken slats were observed until one got out of the trench proper.

Trench foot was considered a matter of discipline more than anything else.

Medical records: Proper to make at the A. D. S. and M. D. S. In a rush may be made at the C. C. S.

Army Sanitary School No. 22.

VISIT TO BRITISH CASUALTY CLEARING STATIONS

December 15, 1917

The whole class left in four auto ambulances to make a tour of some 70 miles for the inspection of casualty clearing stations.

Casualty Clearing Station 18.—This hospital was of the old type and consisted of double-walled marquee tents. It was pleasantly situated amongst some trees at the side of a canal. It was well parked, laid out with good, hard roads, walks, flower gardens, sod, etc. It was a most cheerful and pleasant looking place, as well as being in the most orderly and neat condition. There was no rubbish, as there were boxes in conspicuous places labeled for trash, for newspapers, etc. Whitewash was liberally used. There were no things left lying around.

A broad road led up to two entrances—one for sitting patients and one on the other side of the road, for lying patients. The receiving tent, grouped for the ambulatory cases, consisted of four marquee tents. Three of them formed a reception room and the fourth was for dressing the cases. At the other entrance was a number of these tents for the reception and dressing of recumbent cases. These tents were double walled, had celluloid windows, and were electrically lighted, as they were dark within. They look like small circus tents, and the union between them was accomplished by lacing the doors together and placing a tarpaulin over the joint to prevent the rain from getting in. They were well heated by stoves. Behind these two receiving departments were 4 lines of wards, consisting of 3 wards of 3 tents each. Two lines were for medical cases and two for surgical. Each ward held 30 bed patients, but by removing the beds and replacing them by stretchers they can be made, with crowding, to hold 50. The wards are joined together by covered passageways, sides of canvas, and roofs of corrugated iron on wooden frames. These wards have wooden floors covered with linoleum. There are two stoves to each ward and they were comfortably heated. The beds were enameled iron, well made up, with good sheets, blankets, and mattresses, and were models of cleanliness and neatness. Each ward had a sitting room and library. There were easy chairs, washstands, and comforts. Each bed had a bedside table. All patients in good-enough condition to be up were required to be washed and shaved before breakfast at 8 a. m. R. A. M. C. men live in conical tents. Fire buckets are kept in the wards.

The tents are said to be much warmer than a hut, but are expensive and can not be depended on to last over one season.

While in these wards we were shown a German litter captured at Viny Ridge. It was joined in the middle for easy shipping, but was heavy and cumbersome. It was a clumsy affair.

At the exit all ambulances stopped in front of a "store" which was kept supplied with blankets, litters, Thomas splints, hot-water bags, etc., to replace those left with patients.

We now saw the building used for the reception of dirty clothing for disinfecting. This consisted of a large drying room, heated by the body of a single-cylinder animal-drawn Thresh disinfecter. The opening to the disinfecting cage was left outside of the building, but the heat for the drying room was supplied by the hot machine and the stack, which was laid across the top under the ceiling. This drying room is used for wet clothing and shoes. The temperature within this disinfecter reaches 240° F. and 40 blankets can be disinfected at a time, or 30 kits. The address of this sterilizer is as follows: Thresh Disinfecting Co., No. 4 Central Building, Westminster, Southwest. It burns 200 pounds of coal a day and is very heavy, but is the best type I have seen.

The kitchens were very clean, walls whitewashed, all stoves blacked, utensils neatly hung up, and only the barely necessary articles were visible. The cooks were uniformed, with white aprons and caps. There are six Soyer stoves, which were simply large caldrons with tops. These Soyer stoves are of Germau origin and have been adopted by the British because they are excellent for soups, stews, and coffee. In addition, they had improvised a range with 16 ovens, 4 double ovens on each side, each oven containing 2 roasting pans. It was made of brick and earth, metal ovens being set in which were part of the field equipment of the old British field ambulance. The floor of the kitchen was of concrete. They gave roast meat twice a week, stew three times a week, and the bread came from the base. One reason why this kitchen was so clean and neat was that the things we usually see hanging around a kitchen

were kept in a separate building outside. For instance, there was a room for cook's clothing to hang in, there was a separate meat safe, and there was a storehouse for all cooking utensils and unused material. Connected with this kitchen by a covered passageway was the dining room, consisting of two marquee tents. This was neat and clean. They had a large tank, which was kept outside the kitchen, for drinking water. An interesting feature of the kitchen was the systematic recovery of all fats. Old scraps of meat were boiled and the fats skimmed off. All the greasy salvage water ran from the kitchen sink over a washboard into a series of grease recovering oil drums. The kitchen was located on the bank of a canal and the fall of the water was taken advantage of to create a siphon system in a series of three cans placed one above the other, into which was led, through pipes, the greasy water. The incoming pipe discharged at the bottom of the can, the outgoing pipe leading to the next can below it, was led off below the grease layer, which formed by solidification of the grease in contact with cold water. This was skimmed off once a day and the ultimate effluent was practically free from grease and clean, and was discharged into the canal.

(NOTE.—This conserved grease was sent to ordnance depot to be manufactured into explosives, and the cooks took a great pride in stating that the amount of grease saved produced so many pounds of ammunition.)

The garbage was given to the farmers, but all refuse not taken away was burned in the incinerator.

The latrines were not far away from the kitchen and were an illustration of how the squatting system could be made the most sanitary of all systems simply by good discipline and cleanliness. The latrine proper was a well-protected shed, facing a clump of trees on the canal and within 20 feet was a Horsfall incinerator. The system is known as the MacPherson. The floor of the latrine was cement. Upon this cement floor were 8 or 10 accommodations for the men who were to use it. These consisted of two halves of biscuit tins placed one behind the other and raised by a block at the center, thus slightly tilting the front one forward and the back one backward. The latter tin contained a square of newspaper a little larger than the floor of the tin. Immediately in front of this system was a urine trough, which led down into a urine pit which I was told would last for months without becoming obnoxious. A man entering would squat over the rear tin and evacuate upon the newspaper the residual urine being passed into the front tin. Toilet paper was provided and after cleansing himself the man arose, emptied the front urine tin, which was kept in contact with the rear tin by a flange bent over backward, and then took up his evacuation by bringing together the four corners of the newspaper, and carried it across to the incinerator, the door of which he opened and casting the material in. All men were required to urinate in the urine trough before defecation. One orderly, neatly dressed, was kept on duty at this latrine to insure its proper working and to keep up the fire in the incinerator, which he did by means of camp sweepings and trash dumped there for that purpose throughout the day. The incinerator needed only two pounds of coke a day to start the fire, and from that time on it was kept up by the camp trash. This orderly was required to compel men to observe all of the details of cleanliness required by this system. If any man failed to do so, he had to do it for him. Consequently the place was a model of cleanliness. The commanding officer remarked that it was a system which worked very well for small commands constantly under supervision but would not do, as a general thing, for large aggregations of troops. He also remarked that to make this system work it was wise to always have a very husky orderly on duty. He recommended it as a very good means of educating the sanitary conscience for disciplinary purposes in small, dirty commands. He stated that a pail was provided in this latrine for men with diarrhea. We were all impressed with the absolute cleanliness of this latrine. There was absolutely no odor about it and the tins were bright and shiny. When they get rusty they can be easily thrown away, as biscuit tins are cheap and plentiful. The boards were whitewashed; tarred paint was used on the outside. Everything seemed to work perfectly. Anybody that can run a latrine like this has evidence of being a good administrative officer. It should be remarked that the orderly on duty was always selected because he was a good man and was paid extra—4 pence a day. Charcoal seems to be the proper fuel to insure the proper running of an incinerator. Near the latrine was a large truck garden from which most of the vegetables used at this hospital came, and farther away was a large athletic field for convalescent patients.

The operating theater was in a frame building, and separate buildings—some distance away, and therefore inconvenient—were used for sterilizing and X-ray rooms. Normally this operating room had six tables, but three had been sent away to reinforce another part of the line by operating teams. It was lighted by electricity, but had acetylene for emergency. Normally three teams worked there, and near by there was a ward of eight tents holding 120 patients. All dependencies of this hospital—pack stores, quartermaster's stores, etc.—were neat and clean.

Before leaving we were taken a few yards away to a railroad siding and given a very practical talk on the method of loading and entraining patients. Ten minutes before the train starts the commanding officer of the train is given a correct list of patients in the following order: Recumbent cases requiring Carrel's treatment, recumbent cases seriously wounded, sitting cases, and cases of mental diseases. Infectious cases are always separated. Cases should be loaded deliberately but rapidly in batches of sixes. Carrel cases are loaded first, then the recumbent seriously wounded, then the sitting cases. One of the chief duties of the entraining officer is to see that no man is put aboard the train who is likely to die en route, as this is considered the greatest crime of a casualty clearing station. We were cautioned to exact of all commanding officers of hospital trains a receipt for documents concerning sick and wounded turned over to him. This siding was used not only for casualty clearing station 18, but also for casualty clearing station 23, 4 miles away and reached by motor ambulance over good road. One hundred complete changes of clothing and equipment are always kept on hand in the pack store.

Casualty Clearing Station 23.—This is run by Colonel Safford. This is of old style and is practically a rest station and a station for ophthalmic and gassed cases. It was not on a railroad.

This hospital, old style as it was, was a perfect model of good administration, cleanliness, and attractiveness. It was situated in the grounds of an old chateau, on a high hill, well wooded, well parked, with flower gardens and hard roads. The grounds were taken care of by the convalescent patients. Colonel Safford called special attention to the fact that the road leading up to the entrance of the receiving rooms for sitting and lying cases should be wide and that only two ambulances should be allowed to move up at a time. They usually came in batches of four. As they moved out of the grounds, after unloading, they stopped at a little storehouse for the replenishment of their supplies, as heretofore noted for casualty clearing station 18, but this should be sufficiently remote so as not to cause any blocking of the road near the entrances to the receiving tents. The receiving tents were grouped in bunches of three. Lying cases were received in five marquee tents joined together. We saw here the admission of a recumbent patient. The clerk who took the "particulars" had a little board strapped to his wrist upon which he wrote. The buff ticket when made out is sent to the office and entered up in the admission and discharge book. The counterfoil or stub bears the same number as the ticket and is pinned on the envelope containing the man's history. All dressing tents are provided with the apparatus for heating litters. In this case the heating apparatus was made of a frame of half hoops, covered with canvas and fitted out inside with electric lights. When a man is very much shocked blankets are laid on the floor, the man is laid on them, and a heavy cylinder placed over him, as this gives a high degree of heat. The head is left outside. In the dressing room of the recumbent side was what Colonel Safford calls his "fire-alarm box." It was the inevitable busenit tin, with the open face sealed in by paper and was affixed to the wall. In this box there were the instruments and dressings already sterilized for such emergency cases as could not wait for the hunting up of instruments and their sterilization. Upon the paper was typewritten a list of the contents of the box, which contains the following articles: Tourniquet, rubber gloves, tracheotomy tube, hemostats, scalpel, scissors, trocar, hypodermic syringes and needles, surgical needles, silkworm gut, dressings.

As soon as this box has been opened by putting the fist through the paper, it is taken down and another box similar to it replaces it.

The preoperating room was next seen. It accommodated 40 to 50 patients, and contained trestles upon which to place the litters. Here the patient was washed up, put into pajamas, and heated.

The next room was the X-ray room; and the next the operating room. This room contained 6 tables with 2 tables to a team. It is fitted up with the Wallace-Cowell operating-room furniture and equipment, all of which can be put on a trailer within an hour. It all fits into light, hardwood boxes with trays, one set above the other, very much like the Globe-Wernicke bookcases. When they go on this trailer they are not jumbled in, but are packed up neatly and can be taken out deliberately. The anesthetic tables and instrument tables are enameled iron with glass tops and the operating tables are folding. One of them was a special operating table, also folding, for abdominal cases, under which a compartment containing electric lights was found to heat the patient continuously while on the table. The clerk who takes the "particulars" of the patient and of the operation keeps an eye out for the valuables, or Dorothy bag, of the patient. He sees that it comes into the operating room with him and goes out with him. In this operating room the tables were supplied with irrigating solutions by overhead trolley, which conducted the bottles from one table to another.

We saw a group of tents set apart for venereal cases and one shed, well whitewashed, with a concrete floor and a central stand with large 5-gallon bottles, from which solutions were piped by rubber tubes to hang over a trough in which patients could take their daily irrigation. This place was immaculately clean, and contained also a table with the equipment necessary for the passage of sounds. The commanding officer stated that he had 60 cases of chronic gonorrhea to help him around the hospital. They were used for the rough work in cleaning up. Everything connected with these venereal patients is separated from the other patients. They have their own latrines, baths, and dispensary. The nearest they ever come to the patients is when they are used at times as litter bearers.

If a man comes in without a "T" marked on his forehead he is given antitetanic serum in the dressing room. Here, also, we heard that morphine was also marked on the forehead. A dose of a quarter of a grain being marked as follows: "M $\frac{1}{4}$." The heating of patients was accomplished not only by the canvas-covered frame with electric lights but also by the Cowell method (blanket litter) and by the half-cylinder hood heated from the outside through a stovepipe under which is placed a lamp.

The latrine here was of the MacPherson type also, and Colonel Safford preferred it to all others. The orderly stayed on duty 12 hours.

Officers had a pail system and were provided with a wash basin and soap and towels.

There were two Horsfall incinerators, and it was repeated here that they needed only 2 pounds of fuel a day and that this should be charecoal, but the chief fuel, of course, was camp refuse.

The kitchen was widely open to the air and was most neat—whitewashed and stoves blacked, and cooks were uniformed with white aprons and caps. The floor was of brick.

A special-duty man was kept as a painter; and he must have been a strong man from the amount of paint that we saw.

A Thresh disinfector of the same type as casualty clearing station 18, and similarly housed and used, was seen.

The pack store.—This is a storehouse in which the clothing is kept, and at least 50 full complements of clothing and equipment were constantly on hand to fit out soldiers returning to the front. The usual method is that when the patient is undressed and put to bed his property is brought by an orderly to this storehouse, marked with the wounded man's name and serial number. If the man is evacuated to the rear, and therefore lost to the division, this property is opened and distributed to the various departments for reissue. This includes his ordnance, rifle, etc. If he goes to duty he presents his receipt for his equipment and gets it back. This includes his own rifle. The rifles are cleaned daily by a P. B. soldier of the line; that is to say, a man incapacitated for duty at the front.

All officers leaving the hospital are required to sign a statement that they have received all of their property brought there.

The quartermaster in charge of this storehouse is not an officer of the Quartermaster Corps, but is always an ex-R. A. M. C. man, a sergeant of long service. Colonel Safford said it was very hard to get these positions, as they were very good ones and were kept for medical department men only.

The wards were made of five marquee tents joined together. They were very neat and in general can be compared with this already described for casualty clearing station 18.

The laundry was given out at the rate of 2,000 pieces a week to civilians. The beds were furnished by the British Red Cross, as were most of the comforts. The wards were provided with chairs, tables, reading and writing materials, etc. There was an officers' ward of 18 beds, with a good stove. They had a lounging room, washroom, and reading and writing material.

Other wards hold 22 beds. Wards were classified into bed wards and stretcher wards. Stretcher wards hold 24 patients.

Another feature of this hospital was the accommodations provided for gas cases. There are wards for their reception for cold weather, but in pleasant summer weather they are placed in a long shed, open on the lee side of the wind and sheltered by burlap at the ends and other side. They hold 58 stretcher cases and 8 bed cases for more seriously asphyxiated cases. All gas cases are treated as recumbent cases and are not allowed to walk. It should be added in connection with the shed for gas cases that the stretchers are arranged in fours, with their heads all toward a central oxygen tank, from which tubes lead off to each patient using the Haldane oxygen apparatus.

In going through this hospital I found in a small room a tiny stove which did not hold half a hodful of coal.

There was a hut built for the ophthalmic cases. This contained a dark room, an examining room, and a room for work to be done on the eye. This was a model of completeness and was furnished not only with modern instruments and appliances but had a good dark room. The hut was supplied with electric light.

Colonel Safford called our attention to the fact that a special examination of each patient is made by the orderly officer before the patient leaves the hospital, and yet again at the railway station to prevent moribund cases being put on.

At this hospital we also saw the usual dependencies, including a tailor shop, barber shop, medical comfort storehouse, etc.

We now visited three casualty clearing stations, grouped, in the Canadian sector. This is going to be a very handsome installment, the largest we have seen, as eventually there will be room for 10,000 patients. Each of four casualty clearing stations holds 2,500. While there were some tents and barrack huts, the Nissen hut was the type used. The site was an unfortunate one as far as the soil was concerned. It was on a muddy plain, and roads had to be made at great cost and difficulty. Duck boards were used between wards because the French object to so many paths. There was nothing to be seen inside, as it was not yet finished; but the arrangement for receiving, operating, and housing, as well as for evacuation, was on the plan already laid down by Colonel Safford. We saw here one of the great advantages of a Nissen hut. It was put up rapidly. This enormous hospital was about finished as far as construction went, and it had only taken six weeks. The earth was banked up on either side of each hut and the wooden floors were flat on the ground, allowing no air space beneath, which made them warm. This entire group was sewered and had a general water supply through piping. Each casualty clearing station forming this group had a separate administration. There were no trees and the place was perfectly bare and unattractive, but the Canadians are building to stay and be comfortable.

Casualty Clearing Stations 57 and 30.—This was a group near Arras. These buildings were of the new type. One of them at least was chiefly constructed of Nissen huts, the other mainly of tents; but both followed Colonel Safford's idea of construction and arrangement, and, while much more stable, did not differ greatly from the others. They are on a hill near a railroad station and yet are centrally located, but there are too many ammunition dumps and repair shops around them to make for safety. They have an electric lighting power in common. It was rather late when we reached there, and for this reason we were unable to see everything which we might have seen if earlier.

The capacity of these hospitals is a thousand apiece. The only difference in the plan of admitting and discharging patients was that at these hospitals the entrance and exit were at the same end. The marquee tents very well by the commanding officer. The marquee wards hold 44 patients, while the Nissen huts hold 20, but the cost was tremendously in favor

of the Nissen huts. The Nissen huts were rather hard to heat. In one of the wards a cement heater of our "Franklin" type had been built by the engineers and seemed very good. Officers' wards were lined with tongue-and-grooved lumber, which is painted. They had wooden floors. There was linoleum on the floor, and all wards were models of cleanliness and comfort. It was noticed that some of the Nissen huts have a ventilator running the length of the building, with louvred windows, while others have windows cut in their sides. If beds are taken out they will accommodate 30 litter patients on the floor. The main object of having these casualty clearing stations grouped is because the chief function of a casualty clearing station is to reduce the number of patients to be transported and to keep men at the front. It was noticed that the end ward tents had two end rooms—one for attendants and one for urinals and bedpans and ward utensils. Some of the Nissen huts had 24 beds. All wards were well heated.

There was a dental department in Casualty Clearing Station 57, and it was well equipped. Royal Army Medical Corps men were located in conical tents with boarded floors, 8 to 10 men to a tent. A few barrack wards were found with 40 beds, and a stretcher ward contained 60 of the same type. The baths were excellent. There was always an undressing room and a dressing room, and hot water was obtained not from the "secours-aux-soldats," but from an iron boiler in a stack of the same general pattern but more solid. They had a tank for cooling the water and preventing it being turned on too hot. The baths, hot-water heaters, and sterilizers were all under the control of the quartermaster, who was here, as in the others, an officer of administration appointed from among the old sergeants of the Royal Army Medical Corps. The bathroom had 12 spray heads and a thousand can bathe in two hours, we were told. Each shower head is large enough for four to get under at once. They make a drill out of it. Men stand under the water for a minute, then soap themselves for a minute, then wash off the soap another minute, then they get out and dress. Their clothing is disinfected as heretofore described. We were told that the Infantry in the British Army has a bath and a change of clothing here every 8 to 10 days. At both these hospitals separate baths for officers and for skin cases were kept.

We saw tubs, basins, and shower baths in this hospital. The bucket system with fly-proof top was here used, and all camp refuse and feces burned, but the commanding officer preferred the deep pit, as in this soil it works very well, there being much chalk. They do not care much here for the MacPherson type. At these two hospitals defaulters were required to do this sanitary work, such as emptying pails. Other sanitary men get 4 pence extra per day, but only supervise.

The laundry was washed by civilians with portable equipment.

The arrangement of the operating room in both of these hospitals was by means of Nissen huts. A plan is appended giving the main features, Figure 14. It was lighted and ventilated by a louvred ventilator running the length of the building. It was well lighted with electric light, and there were good closet room, instrument cabinets, hot sterile water in wash basins, with racks for solution bottles, etc. It was lined with tongue and grooved lumber and painted with white enamel paint. There was linoleum on the floor, and they were models of cleanliness. Surgeons of teams here operate 12 hours, spend 4 hours visiting their cases, and sleep 8 hours. At both these hospitals there were 12 tables for six teams. They count upon two teams for every 100 admitted. They keep 3 medical officers in the reception room and dressing room, 2 in the resuscitation room, and 1 for entraining. Same system of taking care of the kit and reissuing was observed here as hereinbefore described. Cases are always redressed for evacuation. Personnel for the ward is 1 nurse and 3 orderlies, but in a push this has to be doubled.

The steward storehouse was really a commissary storehouse with additional medical comforts, such as port wine, canned meat, olives, fruits, etc. None of the latter articles were for sale. It was very well supplied. The officers, nurses, and servants (soldiers) are all messed alike. The waiters are all enlisted men. The noncommissioned officers have a separate mess hall, bath, and rest room. The kitchens were excellent, the best we have seen yet. The lavatory was all whitewashed and black painted. Absence of things lying around. Soyer stoves used.

In Casualty Clearing Station No. 30 we saw the Nissen stove. It was constructed of corrugated iron with interior oven. It will bake for 500 men and needs 120 gallons of water

a day. The floors of this kitchen were cement. The oven was of brick, with sheet-iron sides. There was a special sink with grease traps on the plan hereinbefore described as the Jacobs grease trap, and the water runs out clear into the ground. The incinerator here is used to heat water which is utilized in the kitchen, 4 pounds of charcoal used for the fire a day. One side of the kitchen was entirely open to the air. There was a large Thresh sterilizer here whose heat was conserved to heat the drying room.

We saw in the other hospital a kitchen with two ranges which supplied hot water by coils which ran through the improvised ranges to be used for ablution benches and washing water in the kitchen. There were also 10 Soyer stoves here. The capacity of this kitchen is 500 meals at present. There was a carpenter shop, tinsmith, barber shop, etc., as in other casualty clearing stations.

The two hospitals had one radiologist and one laboratory in common. Gassed cases were in a separate ward. They all have to be warmed because they are very anemic.

Army Sanitary School No. 31.

SICK WASTAGE

By Captain Parkinson, December 11, 1917

In the good old days the division sanitary personnel moved with the division. This made a break in which sanitary conditions were more or less wiped out every time the division left a sector until the new incoming division had adjusted itself. To remedy this the army areas are now divided into sanitary areas which have the same sanitary personnel at all times regardless of the division surgeon who may occupy the area. Indeed the area may take in terrain occupied by other divisions, and even other corps. All these sanitary areas in each army are under the sanitary A. D. M. S. for the army. He is not a corps officer. This is a good system because it keeps the area under the same officer, who has about the same responsibility as a civil health officer back home. In 1914 there were 17 officers in the sanitary department and now there are 200 of these officers and 2,000 of other ranks. Each corps has a sanitary section manned by army troops assigned for duty with the corps. It was the constant change of divisions that led to this area sanitation, as well as the bewilderment of the civil population, who, after seeing contradictory ideas of incoming sanitary officers, lost interest in cleaning up. The sanitary officer is by no means always a doctor. He is often a sanitary engineer. Captain Parkinson strongly deprecates excessive letter writing. He states that the whole matter of sanitation is one of individual effort anyway, and a sanitary officer should not merely come up and "look at things" when something goes wrong, but he must do something to remedy it. It is necessary to have good none commissioned officers as inspectors, and to praise them where for any successful effort praise is due. There must be constant supervision of the sanitary area. The sanitary officer should get the sympathy of his commanding officer. If he doesn't he has failed. He must get to know the men, especially the none commissioned officers, and work not only on their sympathies but on their pride.

Food dumps.—These are raised platforms for supplies at the rear, but toward the front and on the marches the food often has to be dumped on oilcloth spread on the ground. Food must be looked after personally to see how it is handled. Food should not be condemned en masse, but only the parts of it which are unfit. Don't condemn a whole carload of cans of milk because one can is bad; try to salvage all you can. As a matter of fact most epidemics of intestinal diseases are due to civilians. The storehouses of food should have correct ventilation. The doors should be flyproof. The bread should be put on racks and meat should be kept away from other food in meat safes, protected against flies, vermin, and animals. It is just as important to protect clean food as to attend to garbage disposal.

Cookhouses.—It makes no difference how close a cookhouse is to a latrine, provided the latter is clean and fly proof. It is better to have a battalion cookhouse than company cookhouses. It is more economical, there being less wastage, and can be kept clean better. There should be 12 additional pairs of overalls to allow of frequent washing and change in uniform. The medical history of cooks should be kept and care should be taken that they are not carriers of typhoid, paratyphoid, or dysentery. Keep the kitchen clean without the

use of lime, but whitewash the walls constantly in order to make it look the part. Don't have a lot of truck lying around—boxes, cleaning material, rags, dirty cans, waiting until some one has time to dispose of it or some use comes for it, and all that sort of thing. Only have the utensils out that are absolutely necessary for constant employment. Especially look out for the officers' cookhouses. The cookhouse should have impervious floors and metal receptacles should be on hand, one for empty tins, one for solids, and one for liquids. It is well to have tins for scraps of meat and fats. There is no excuse for a cook being dirty if he is allowed enough clothes to keep clean. You should see that there is a variety about the food. Don't give the men stew every day. Save the fats from waste meats and the grease from greasy water. Enough fat was saved from this source last year to provide 10,000 rounds of cordite ammunition. Above all, do not allow the men to keep their personal equipment in the kitchen. A cook can serve 250 men with 4 or 5 pounds of coal daily. Meat blocks are better than tables because they can be kept cleaner and there are no cracks for meat to rot in. Wooden-handled knives and forks are a positive danger and should be tabooed. Bread 10 to 12 days old, if warmed in a damp cloth, will be fit to eat. The rolling kitchen is excellent—cooks for 200. One should always avoid jumping on the transportation corps any more than possible. They have their troubles.

Diseases.—The greatest cause of sick wastage is reduced vitality from overwork and poor food, constant cold, and insufficient sleep. It is an ill-conceived idea of a commanding officer that troops to be efficient should do arduous service and be deprived of comforts and necessities. This is not the time nor the place to weed out the unfit and the wise commanding officer will endeavor to keep all his men and not only select few who can rise above his silly selective processes. It is vicious to get men up before sunrise, give them their breakfast in the dark, and start them out in the cold morning mist, chilled, underfed, and usually with wet clothing, to do an arduous day's work, terminating again in cold and wet. Such men, after supper, with clothes still wet, even have lectures running into the night. This is called "intensive training."

At the outset we should recognize that the allied armies are composed of troops from many countries, who generally bring their diseases with them.

At the very head of diseases that actually cause loss of efficiency is scabies and its frequent sequela, impetigo. It is a very bad thing to have scabies started in a command. The men are shunned who have it, and this breaks their spirit. Old cases are apt to end in impetigo (I believe that this name should be changed to ecthyma). Scabies is mainly spread by blankets, which should be regularly disinfected for all the command, and dry heat will get rid of it. The Thresh disinfector is not the best way to disinfest blankets, and dry heat is preferred. Now impetigo means a loss of from 10 days to 3 weeks at the base; and scabies means a loss of good 50 per cent of a man's efficiency from loss of sleep by itching and scratching. By far the most serious ectoparasite is the one causing the last. Nearly all cases of pyrexia of unknown origin (p. u. o.) are accompanied by lice. This p. u. o. is a serious cause of sick wastage among the English. In fact one should look upon the louse as a winter pest and danger as we look on the fly in the summer. The disinfestation of clothes for lice and scabies with dry heat is accomplished at 60° C. for half an hour, and the plant should be attached to the baths and the men's clothing disinfested while they are bathing. At this bath there is a noncommissioned officer of the Medical Department, trained to recognize scabies, lice and the leading points in skin diseases, and he notes the name of any man whom he thinks ought to go before the medical officer. Scabies should be isolated. The bathing facilities ought to be good and they should be divisional. Bathing should be made a parade.

Intestinal diseases.—Ninety per cent of the British are inoculated against typhoid fever and paratyphoid, but such inoculation is unfortunately not compulsory. The Germans inoculate for typhoid fever and cholera every six months. In the British Army last year there have been 33 cases of typhoid out of 250,000 men. The mortality is low—1 to 30. Typhoid fever epidemics amongst civilians have often been a source of serious alarm amongst the British. Vaccination of them ought to be compulsory. Captain Parkinson considers the typhoid is usually spread by carriers. He also believes that it lives in water three weeks (which I do certainly not believe). The water detail is composed of 1 noncommissioned

officer and 4 men of the Royal Army Medical Corps. They hypo the water and leave it stand all night, but it is necessary to remember that the hypo should be kept in a dry place and kept dry.

In running the water-cart system do not use the rule of thumb in doing the hypoing, but establish the dose of bleaching powder in test by the Horrick apparatus. A water detail should never be changed and should be examined to see whether there are any typhoid, paratyphoid, or dysentery carriers. The cart should be cleansed before adding the water to be chlorinated. It should stand every night for use the next day.

Typhoid inoculation is compulsory in the Canadian Army.

Dysentery.—Amebic dysentery is rare, but there were 188 cases of Shigo and Flexner in six months in this army. To avoid Flexner and Shiga dysentery, when men go into a place where the water can not be properly sterilized they are given each a bisulphate of iron tablet to drop into their canteens, and thus sterilize their water. Dysentery, in fact, causes more trouble than typhoid fever.

Captain Parkinson has tremendous faith in the use of portable laboratories and strongly recommended them.

Better sanitation has left its mark on the infant mortality of France, which has decreased in these parts of the country occupied by the English.

Other infectious diseases.—The exanthemata; one rarely finds it necessary to quarantine suspects, but instead of this they are examined every day between the eighth and fourteenth day after contact. In diphtheria and cerebral spinal fever three swabs are taken before discharging the patient. The Levick spray has not proved itself to be of any value, using chlora-mines T in the case of mumps. In fact, in a case of diphtheria, it had produced no effect at all on the bacteria after five exposures of the carriers to the spray.

Trench foot.—This is largely a matter of discipline. The cause is constant standing in wet, and impaired circulation. Twenty-four hours is the limit for a tour of duty in a water-logged trench. Gum boots are useful when actually at work in the trenches, but they are to be used only for this purpose and are to be removed when the necessity is passed. Rubber boots are not suitable for dry cold.

To prevent trench foot they wash the feet frequently, dry them, and rub in whale oil. This massage is the chief thing. Every man should be required to carry an extra pair of dry socks, and in addition to this dry socks are sent up with the food to the trenches. There is sick wastage for trench foot and it has been as high as 0.765. Dry socks should really be put on twice daily, when boots should be removed and toes exercised. When the feet are cold, heat should be avoided. Feet should be kept moving all the time, the shoes two sizes too large and kept as dry as possible. Puttees should not be worn. The powder used for trench foot is as follows: Potash soap, 300 pounds; camphor, 32 pounds; sodium borate, 35 pounds; talcum powder, 500 pounds. The trenches should be well drained and kept so.

If trench foot develops in a command the commanding officer has to be grilled on the following questions, in the form of a report which he makes out every time for each man acquiring trench foot.

1. Frequency of baths.
2. Frequency of changes of socks.
3. Length of time on duty and where.
4. Condition of trenches.
5. Efforts made to improve trench conditions.
6. Reason for failure to attain improvement.
7. Were unfavorable conditions reported? If not, why?
8. With what result?
9. Condition of dugouts.
10. Condition of other men of platoon.

This army evacuated in 1915-16, 3,311 trench feet. In 1916-17 there were 395 evacuated for this trouble. This is due to better care of the feet and better trenches. One should remember always that in the case of trench foot you should use antitetanic serum.

Army Sanitary School No. 33.

LECTURES

By Lieut. Col. W. L. Keller, M. C., United States Army, commanding Hospital V. R. 76.
December 4, 1917

Class took 7.10 a. m. train, Gare du Nord, for Ris-Orangis to visit Hospital Complementary, V. R. 76, commanded by Lieut. Col. W. L. Keller, M. C., instructor in war surgery of the Army Sanitary School. Arriving at 8.30 a. m., they were met by Colonel Keller and conducted to his hospital.

It is of brick, of five stories, architecturally agreeable to the eye, and surrounded by extensive and well-parked grounds. It is provided with electric lights, piped water supply, and central heating, and compares favorably with a good type of Paris hospitals. The arrangement of wards, operating rooms, etc., was good, and the neatness and cleanliness of the institution was striking, as was the provision made for comfort of patients and for the necessary medical and surgical supplies. The staff was sufficient but not top-heavy. The nurses were English speaking as a rule and everyone had his or her duty cut out, and the director generally saw to it that this duty was rapidly and efficiently performed. The administration of this hospital was excellent.

The hospital was one of those special surgical hospitals of the French for the treatment of complicated fractures and was formerly under Doctor Blake, of New York. As a matter of fact, 100 per cent of the fracture cases were infected when they arrived, generally in quiet periods, from the hospitals nearer the front and in time of activity from the battlefield sanitary units. Hence the director received his cases from two weeks to two months after receipt of their injury, or, in time of activity, from several days to two weeks after an advance. There were some 200 patients at the time we made our visit, some of which were convalescing from fresh wounds received in a recent push. The normal capacity was 450. All were French, in excellent general condition and high spirits, and it was noticed that they had the most profound respects for Colonel Keller. Most of the cases were handled by front-line organizations before they reached Colonel Keller, and they appeared to be either exceedingly serious cases of compound fractures of thigh, arm, hip, and shoulder, or they were serious cases unsuccessfully handled in less elaborately equipped hospitals.

There were a very few details worthy of special mention which concern the general administration of the hospital. The arrangement for washing ward utensils was unique. On each floor in the corridor and in full view of passersby there were slop sinks, capacious and clean. Overhead was placed a short hose with nozzle and stream of water sufficient in itself to dislodge material which had adhered to vessels. All patients had attached to their histories, on a board upon the bed, a drawing or tracing of not only the last X-ray picture made, bringing out clearly the position of bones, fragments, and bits of projectiles, but of all previous ones. The clerical work connected with the case is done chiefly in the wards. It is not too much to say that Colonel Keller knows everything that goes on in his hospital at all times, is familiar with the daily condition of each patient, and is tireless in his efforts to get the most out of the machine. It was interesting to hear him describe himself what, after all, was the secret of his success:

"The surgeon, being the party responsible, must not only order things done, but he must see that they are done properly."

THE FRENCH SYSTEM OF EVACUATION

In general it differs from the English, "a horizontal system," in that its control is vertical; i. e., the wounded man is under the same supervision from front to rear, from start to finish. Colonel Keller evidently believes in the famous French "triage," so bitterly criticised by many of the French surgeons who have to use it at the front.

THE GENERAL TREATMENT OF WOUNDS OF WAR

All war wounds now can be considered to be infected. Consequently the earlier we attack a contaminated wound, the less chance there is of subsequent infection. The chemical sterilization of wounds in war was until recently all we possessed to not only combat the danger of infection, but the infection itself. To-day we accomplish by means of excision of

the tract of the projectile, removal of foreign bodies, and subsequent primitive suture in wounds of soft parts what until now was accomplished by débridement and Carrel's irrigation of the open wound in an intermittent current of the hypochlorite solution of Dakin. But primary suture can thus be accomplished only before real infection has begun; i. e., before 8 hours have elapsed after the receipt of the wound. After 8 hours up to 12, such sutures are exposed to failure from infection and after 12 hours Carrel's method must be adopted. If primitive suture is applied, the patient must be kept in the hospital where it is performed until two weeks have elapsed. To transfer them before subjected them to great danger of failure to avoid infection.

The primary suture of wounds is only practicable when they are received in small number and within the first 10 or 12 hours. The primary suture retarded can be practiced when they are received in large numbers; that is, during a big offensive. In this case, the wound is excised, all foreign bodies removed, and a flat dressing applied. The patient is then ready for transportation to the other formations in the rear where he can be sutured on the first, second, third, or fourth day without further sterilization. There are some cases on record which have been done as late as 24 hours with considerable success, but that delay should be avoided.

After the battle of the Aisne, 30 per cent of the men suffering from wounds of the soft parts were given 10 days' leave, 32 per cent three weeks' leave, and 38 per cent two months' leave, and so all these men returned to their regiments in a short time. All wounds that had not been excised within the infective period were subjected to progressive sterilization and secondary suture practiced. The great majority of these wounds can be closed and a large proportion can be so reduced in size as to decrease the dressings and discomfort of the patient. Secondary suture is usually performed after a bacteriological examination of the discharge shows a count of 1 organism to 3 to 5 fields, or a pure mucoid discharge for five days when laboratory facilities are not at hand. The superficial carpet of granulating tissue with the cicatricial margins is usually excised in one mass, the wound is undercut, and an effort is made to bring the underlying surfaces in correct anatomical position by a modified figure-of-eight suture which lowers the tension and allows perfect apposition of the skin and in many cases, leaves a movable scar.

The use of catgut is to be avoided in these cases, for if it should become necessary to use Carrel-Dakin at a later period it is immediately dissolved and fails to hold the structures in place. Colonel Keller states that few skin flaps die from lack of arterial blood supply, but many from venous congestion, and consequently he makes multiple stab wounds in the skin to reduce the tension and provide additional drainage.

He laid special stress on the use of methylene blue as an aid to map out the sinuses leading to sequestra and, in some cases, to projectiles with discharging sinuses.

Fractures of long bones.—The main point is in securing traction from the first and sustaining it until union takes place. The possibilities of primitive and retarded primitive suture, reducing infection in compound fractures, is giving promise of great success, but great care must be observed in the débridement to spare as much bone as possible when there is great loss of substance. Any bone attached to the periosteum must be left to bridge over the space which would otherwise result in a pseudoarthrosis. In these cases the sequestra can be removed by operation at a later date if necessary.

In fractures of the long bones, Depage starts immediate progressive sterilization with Carrel-Dakin as soon as the wound is excised, and his success has been beyond all expectations. Before secondary bone operations always give antitetanic serum.

There are in France 168,000 men who are walking around with sinuses at the present time, four-fifths of which might have been avoided if progressive sterilization had been started.

The Thomas splint, or some modification, is the one which seemed to be most used for traction purposes, and a demonstration was made of the splints which are commonly used to-day.

No. 1, Thomas, most used; the padded ring fits well into the gluteal fold, and counter-extension is secured against the tuberosity of the ischium. A long rod of iron descends on the inner aspect of the lower extremity, passes under the arch of the foot at some distance,

forming like a stirrup, ascends along the outer aspect of the lower extremity, both ends being fixed in the rim of the ring. An anklet over the shoe is attached to the stirrup and tightened with the Spanish windlass to get traction during transportation. A cradle is formed by a double bandage passing under the extremity, two under the thigh and two under the leg, and a fifth one passing under the flexure of the knee. The latter must be taught to secure a slight flexion at the knee.

No. 2, Blake splint, easily applied as it does not have to be threaded over the limb, but it gives more or less uncertain traction during transportation as the screws of the sides are jarred loose when the splint is bent. Rights and lefts are required.

The Keller splint, or half ring hinged to set an angle of 55° and padded to rest against the ischial tuberosity. It has the following advantages: Small cost, easy to transport (10 of these splints can be in the same space as 2 Thomas splints), it is easily applied, and can be used for either right or left extremity.

Thomas arm splint, used mostly for transport.

Jones humerus traction splint, is a padded half ring which permits extension of the humerus with flexion of the elbow.

Jones crab splint, mostly used for holding the hand in dorsi-flexed position as in cases of wrist drop.

Posterior wire splint.

Hodgens splint.

Sinclair's modification of Thomas arm splint.

Ladder splint.

Wallace splint.

Spinal splints.

Plaster of Paris is not much used and seldom advocated in the fractures of war wounds owing to the possibility of gas infection escaping detection in the area covered. Wooden splints are also supplied to be used in emergency for fracture cases. When a patient with a fracture of femur or humerus reaches a well-equipped hospital where he is to stay, he retains his Thomas or Jones humerus splint, but the hospital exchanges a similar one for that applied to his limb. The Spanish windlass is removed and traction is procured by the lateral strips on the sides of the limb, or adhesive plaster, Heussner's or Sinclair's glue being the two favorite preparations used to attach the flannel bandages to the limb. The strips are attached to a small perforated board, which in turn is connected with the rope and pulleys as described in the Splint Manual issued by the medical board of which Colonel Keller was president.

All cases of overriding fractures of long duration and without consolidation are immediately put on sufficient traction to paralyze the contracted muscles. This varies with the individual and the condition of the limb, but 20 to 35 pounds for the first 8 to 15 hours, accompanied by morphin or codein to relieve pain, will result in complete relaxation in many cases. In those cases which are not improvable by this method, a tongs or a Steinman pin for traction from the knee is used. Great care must be exercised with some patients in regard to the ligaments of the knee joint, as excessive weight will injure them about the third week in many cases.

After the traction has resulted in bringing down the fragments to normal position, they are easily maintained by a weight of 15 pounds in the average cases. All patients in apparatus are X rayed by a portable machine as often as is necessary to convince the surgeon that the fragments are in good apposition. It is not necessarily a cabinetmaker's approximation, as the main object is to strive for alignment and a plumb joint that will give a good functional result even if there is some deformity at the seat of fracture.

In going through Colonel Keller's wards, the application of all these splints was seen. Each bed had its elaborate frame, making a forest of rings, ropes, pulleys, and crossbeams. The apparatus is so arranged that the patient can move himself in bed in almost any direction with great ease by a handgrip. The weights and counterweights and ropes leading through the pulleys enable the limb to be swung in mid-air, thus permitting easy and rapid dressing of wounds with a minimum of pain.

Many cases of fractures had united in bad position before being admitted. These cases are not interfered with for several months and until all infection has disappeared, and

then only after administration of tetanus antitoxin before any operative procedure is instituted. In many cases of compound comminuted fractures any effort to bring the bony ends in position may result in tetanus, gas gangrene, or metastatic infection if attempted during the active stage.

Sequestrectomies are often performed in these cases when the wounds fail to heal after prolonged use of Dakin's solution.

One point emphasized by Colonel Keller in this demonstration was the great importance of early traction from the time the man is wounded, and this can be accomplished by a Thomas or hinge splint, which we hope to have at all places close to the front, as well as in a certain proportion of ambulances.

The most important part of the after treatment of fractures is the daily movement of the joints, but not necessarily movement to a degree that would cause the inflamed muscles in the vicinity of the fracture to be irritated by motion over the infected areas. Muscles of the limb are massaged, tendons are moved within their sheaths, all having one object in view; that is, of preserving a muscle from the degeneration of disuse against the time when it must move the joint in the vicinity of the fracture, and this is only possible by daily massage and motion.

Joints.—In fractures involving the elbow joint, after the foreign body has been removed, mobilization is now practiced instead of immobilization, and this is immediately started after the patient comes out from under the anesthetic.

The same treatment applies to the knee joint where the destruction has not been too great, and Wilhelm has procured exceptional results in even extreme cases.

Special fractures.—Femur: The mortality is exceedingly high in fractures at the neck of the femur, and few of these cases reach a base hospital. They should be usually treated by extreme abduction and suspension. Subtrochanteric fractures also call for extreme abduction and traction (as well as abduction of the other limb).

Fractures of the shaft can be treated by traction and suspension, and the amount of abduction used is very slight, but this depends on muscular injuries and exact location. The Hodgen's splint or straight splint can be also used in these cases. In supracondylar fractures of the femur the displacement is such that it may be more easily controlled by a double inclined plane and a Steineman pin if infection is not too great; if the infection is severe, a straight pull without flexion may be necessary to avoid gravitating of septic material through the muscular planes into the upper part of the thigh.

Fractures of both bones of the leg are usually treated in a Hodgen's or in a straight splint, with traction by lateral bands attached by Heussner's glue. The foot is maintained at a right-angle position by a strap going from the sole to a pulley which holds it at proper angle.

Fractures of one bone of the leg are treated in the same manner.

Humerus: Treatment of the surgical neck. The right-angle abduction of the arm is practiced in the treatment of these cases, the line of traction being that of the latissimus dorsi and pectoralis major, which makes it in the axis of the limb.

In fractures below the insertion of the latissimus dorsi and pectoralis major, or above the deltoid, traction and suspension with abduction is used, but the degree of abduction is reduced.

Fractures of the middle third require little abduction and can be treated by direct pull in the axis of the limb with a cuff at the elbow or lateral straps attached by Heussner's glue; 5 to 6 pounds is the maximum weight.

Supracondylar fractures are usually treated by pull in almost the same axis; little abduction is required.

In fractures of the middle of the humerus, after healing is complete, they can be treated with the Jones's humerus splint with the greatest satisfaction.

Forearm: Position depends on location of fracture of either bone. Fractures of both bones with infection is usually treated in supination with extension.

Shoulder joint: He advocated saving the head of the humerus, or as much of it as possible, as in cases with comminuted fractures he procured good results from ankylosis to the scapula at right angle. This allows full play and a greater range of motion of the shoulder. He showed cases of resection of the head which left the patient in almost a helpless condition.

In conclusion of the remarks on the fractures, Colonel Keller made clear that bone grafting should not be attempted as a rule until one year after healing of the wound. This, of course, applies to infected cases, and regardless of this statement, he showed 4 successful cases of bone graft in the hospital treated in a shorter space of time. He also mentioned the futility of bone plating in early pseudoarthrosis, where the ends brought together usually fail to unite, owing to the absorption of the upper end of the distal fragment.

Special surgery.—Colonel Keller's experience was by no means limited to fractures. Many wounds of the chest and severe wounds of muscles, nerves, and, in fact at times, most other parts of the body complicated these fractures. His remarks on surgical conditions in certain regions included the following:

Brain and skull: Previous experience of operating at the front in all injuries of the skull and brain, especially by those not trained for this class of work, has led to more conservatism. Decompression is no longer looked upon as a cure for all brain conditions and is avoided as an early procedure in infected war wounds of the skull, except in progressive hemorrhage or when the X-ray leaves no doubt as to the real operative indications. Do not transport grave cases; use local anesthetic if possible. Sitting posture when practicable except in shock. Remove only superficial projectiles and bone débris which are easily reached. Through and through wounds of the brain, drain with rubber tissue; never with gauze.

In fractures with injury to the dura, no foreign body present, early excision to sterilize wound should be limited to the removal of contaminated tissues. All cases that may be due to edema incident to the traumatism of a high-explosive missile should be treated conservatively and no extensive work should be done except at a properly equipped hospital with X-ray facilities, a surgeon who has had special experience in this line of work, and the services of a neurologist at his call.

Chest cases: Chest cases are treated in the semisitting position except when there is extreme shock. It is generally considered that the sooner a wound is relieved of its infection-carrying agents, the better; i. e., clothing, missiles, blood clots, the latter being a suitable media for the growth of bacteria. Excise tract, clean wound, remove foreign bodies easily reached, and reset fractured ribs; sew pleura, muscles, and skin when possible; if unable to close pleura, muscles and skin when possible; if unable to close pleura, close muscles; if unable to close muscles, close skin; if unable to close skin, close with gauze as it lessens shock by steadying the mediastinum and permits the sound lung to functionate normally. The mortality is much lower with early closure; in 99 cases where the pleura was drained, 50 per cent died; in 57 cases completely closed, 29 per cent died.

Group "A": (1) Entrance and exit bullet wound; (2) entrance and exit wound (shrapnel ball); (3) wounds caused by small fragments of high-explosive missile. These cases do well when treated conservatively; results good.

Group "B": (1) Wounds caused by large irregular fragments of high-explosive shell which have lodged in the thorax and carried in clothing and other infected material into the cavity; (2) tangential wound of the thorax, enfilading ribs and driving portion of bone into the pleura and lung; (3) entrance and exit bullet wound—exit explosive in character.

Group (1) needs immediate radical surgical procedures as close to the firing line as practicable; (2) and (3) more frequently developing hemothorax or pyothorax, can be drained later.

Hemothorax: Some cases bleed freely for many days, whilst others go on fighting; rest in bed; do not aspirate for two weeks as hemorrhage would recur.

In the large sucking wounds of the chest, the shock is great and the wounds should be closed in every case if possible for the reasons already stated. Always keep patient under observation for two weeks after operation. If empyema develops, treat by the Carrel-Dakin method until the bacteriological count shows but 1 organism to from 3 to 5 fields and then close.

Abdominal operations.—No class of surgical work taxes the judgment of the military surgeon more than a decision as to the proper procedure to be followed in abdominal cases. Symptoms are unreliable; surgeons differ as to results of operation; many patients are beyond help of surgery when they are first seen. Of those in a condition where operation might be beneficial, some would recover if left alone; and whilst the tide might be turned

in a broad proportion of cases by operating, the patients also might die from shock incident to operative measures. In many of these cases operated upon during this war, it was perfectly evident that men died from shock, as there was no sign of peritonitis at the post-mortem, and consequently deciding when to refrain from operating in such cases taxes the discretion of the ablest surgeons.

Wounds of the middle section of the abdomen are much more fatal than those of the lateral, and those of the umbilical more than those of the epigastrium or hypogastrium.

Wounds of the liver frequently call for surgical interference in cases of hemorrhage. The same may be said relative to the kidneys and spleen.

Stomach.—Prognosis in stomach cases when the organ is empty is often good when treated by conservative methods. In wounds of the duodenum and colon, the prognosis is better as the paralytic distension met in wounds of the ileum is not encountered. Colostomy is frequently necessary in wounds of the rectum and cecum. When possible, close abdomen after operation, do not drain, do not operate after 36 hours.

In thoraco-abdominal wounds, make incision over the wound; section the ribs down to diaphragm and incise diaphragm to the point where missile has passed through it; remove foreign bodies and suture abdominal organs which have been injured; remove all clots in pleura, dry cavity and close without drainage; less shock than in the double operation.

Tendons.—Unless prompt massage is instituted, there is danger of fibro-fatty degeneration of muscle and adhesion of tendons to sheaths.

The class was now shown a large number of X-ray plates and received a lecture on the method of rapid localization of shell fragments by Mr. Gage.

Army Sanitary School, No. 36.

VISIT TO MOTOR AMBULANCE CONVOY, RED CROSS DEPOT, STATIONARY AMBULANCE 39, GENERAL HOSPITAL 70, AND THIRD CORPS MOBILE LABORATORY

MOTOR AMBULANCE CONVOY

This consisted of 50 ambulances of the usual type, 2 truck repair shops, 1 field truck, 4 motor lorries, and 7 motor cycles. There was a captain of the Medical Corps in command and an administrative officer in charge of the repair shop. There were 129 men, mostly Army Service Corps. There are three of these convoys to each army—one to each corps and one in reserve. They are usually divided into three groups and thus they serve groups of casualty clearing stations under the orders of the commanding officer of the ambulance convoy who has the location and name of the driver of every car under him. The method of keeping track of the cars is ingenious. There are boards hung up on the wall with hooks. The number of the car and the name of the driver are painted on a clothespin, which is placed on the board corresponding to its location; that is to say, for every date the whereabouts of a certain ambulance is on that board in its place. If in the shop it will be on the board corresponding. The cars are sent up as needed to the sections they serve, and their runs are sometimes long. They never travel in groups of over three owing to danger from shell fire. The cars are in excellent condition. The repair shop repairs all breakdowns, as well as tires and tubes. The machinists are experts and they state that they can repair any car within six hours no matter what is the matter with it—a general statement which, while it may not be exact, shows that they can certainly promptly handle the ordinary repairs needed. This is greatly facilitated by having one type of car and spare parts for same. There were several cases of broken axles being repaired while I was there. There is not much breaking down of cars, as the men are very careful with them and they are kept immaculately clean. No car is allowed to stand muddy, either here or elsewhere. They are free from scratches and always look as if brand new. The men are quartered in Nissen huts where there is also a small dispensary for them and a medical officer. Here, also, an improvised Turkish bath had been rigged up by the men themselves. This organization was very alert. There was a good deal of work done in the office in keeping track of cars and official correspondence, but all of their records were kept in boxes, in which they were packed, and they stated that they could get out of the place with all their records in half an hour. This headquarters is 26 miles behind the line at ———. This organization had a place for amateur theatricals.

The power and light for the repair shop come from a dynamo run by one of the machines.

THE RED CROSS DEPOT

This is in the Army area near an old church in a quiet town, occupying several buildings and filled with tons and tons of supplies. There was a very close watch kept on the output of articles, and the office had a very fine system of filing in special cubby-holes the requisitions from each of the units they serve. It was stated by the representative of the Red Cross in charge that he promptly gets out these supplies on approved requisitions by the A. D. M. S. They provide all material which may be of value in the treatment and for the comfort of the sick, wounded, and personnel of the medical department. That this was a pretty extensive list can be seen from the variety of articles kept. Storehouses were filled with clothing, in which were seen pajamas, sheets, towels, bed linens, bath robes, sweaters, mufflers, blankets and pillows, cigarettes, games, fancy foods, toilet articles, soap, polish, brushes, phonograph records, chairs, chinaware, glassware, cutlery, and surgical dressings and auxiliaries. The Red Cross storehouse had also Fowler bed frames, tin buckets, etc.

At the time of our visit they were making up an enormous number of packages of Christmas presents, with many little luxuries, cigarettes, candy, bouillons, nuts, etc., for the men.

One of the things which interested us was the matter of transportation. This is facilitated by the quartermaster, but they have some transportation of their own. The great difficulty they have is knowing where to find these organizations, as the area which they serve is very large. We were struck by the very small number of personnel at this big depot and the lack of confusion, although it was a very busy place.

STATIONARY HOSPITAL NO. 39

This was chiefly a center for nervous affections, especially shell shock, and we were given a little talk on the subject of war neuroses by Lieutenant Colonel Irwin, in command of the hospital. It is well behind the lines. When cases of shell shock are admitted they are immediately put to bed after examination, kept absolutely quiet and given very little medication, but baths and massages are liberally used. A good force of nursing sisters is on hand here. Later on the men are gotten out and are given a mixture of recreation, light work, exercises, outdoor sports, etc. As a result of this kind of treatment the greater part return to their regiments in six weeks. As a matter of fact, patients usually remain here from 10 to 14 days only. Only five of several hundred have been readmitted; and it is the rarest thing to have shell shock initiate any mental disease, which seems to indicate that there is some pathological change caused in the nervous system by the bursting of shells. The capacity of the hospital is from 400 to 450, but they can expand to accommodate a thousand men. The hospital is mainly in the buildings of an old fort, used as a prison, a very picturesque station and in very neat condition. It is expanded by Nissen huts and other buildings. There is a bomb-proof corral, which really is not bombproof at all but only splinter-proof, but it furnished enough protection to prevent the men from worrying in case of a night attack by avions. The stationary hospital is a frame unit, but the personnel and the character of the cases treated is not fixed. There are the hospitals at which specialists are found, and at this one there were 13 officers, 17 nursing sisters, and 200 of other ranks. There was an X ray and operating theater. The bucket latrine was used. Around the firebox of the incinerators of these latrines hot-water coils were wound which communicated with large storage tanks for hot water. The nursing sisters were quartered in Nissen huts. There was a section of the hospital turned over to the Portuguese medical department for treatment of their cases, as they were in a sector near by. The whole atmosphere of the place was cheerful; and although outdoor sports are obligatory, the men seemed to take to them very kindly. We found several groups playing ball, and Colonel Irwin seemed very confident that most cases of shell shock could be coaxed back into shape by a combination of rest, recreation, and exercise alone. We saw some very interesting cases of shell shock, one of which seemed to be hysteria, and in another diagnosed hysteria there seemed to be a definite lesion.

Case No. 1.—Man admitted two or three hours before was lying in bed with chronic convulsions and apparently unconscious. Colonel Irwin said he would be down playing ball in a couple of days. The pulse was rapid in this case.

Case No. 2.—Man entirely unconscious and apparently very much shocked. Just admitted four or five hours before. He was curled up and his pulse was slow and weak.

The pupils in both these cases were dilated.

Case No. 3.—Said to be hysterical paralysis of left hand, extending over six months. They said he was getting better, but it was noticed that he had some fibrosis of the muscles of the forearm and some false ankylosis of the joints.

Before a man leaves the hospital his case is summed up and the commanding officer personally examines him in the office. When the sum total of evidence points to malingering, a report is made to the commanding officer of the regiment from which he came that he may be disciplined at the source.

The colonel states that some men discharged from the hospital are never good for service at the front again and are only fit to be P. B. men. Still others have to be gotten out of the army. An interesting sidelight on the methods of the hospital in treating these cases is seen in that they have retained certain men who have been encouraged to develop a specialty which made them useful around the place. As an example, there was one who had a knack for charging soda-water bottles. A plant was provided for him and he is producing the aerated waters used at the hospital.

GENERAL HOSPITAL NO. 70

This was a fine hospital in a quiet town 25 miles from the front; situated in a monastery and school. The hospital itself had 600 beds, but with its infectious diseases camp and out-buildings held 1,500. There were only 300 patients at present in the hospital. The attendants were in tents, as they could not get labor to put up huts. This hospital would be called a base hospital in our Army, but the English are very much more careful with the use of their terms than we are. They reserve the name "base hospital," with a few exceptions, those being near ports. This hospital made a specialty of receiving chest, brain, and fracture cases. The personnel consisted of 20 medical officers and 78 enlisted men, but there were a large number of nursing sisters.

We first visited the wards devoted to fracture cases. We were reminded of Colonel Keller's remark that the English had a better comprehension of the subject of extension of fractures than any other army, and it is true. In many cases the Thomas splint had been left on, but extension, of course, had been secured by adhesive straps to the sides of legs and afterwards suspended by ropes through pulleys on the usual bed frame. The handgrip for patients was noticeably frequent here and allowed free movement of patient in bed and change of position. Plaster was not used to any extent. One of the most interesting apparatuses that we saw was one for the treatment of fracture at or near the neck of the femur, with involvement of the buttock, rectum, bladder, and pelvic bones. It was a mesh sloping back from the foot at an angle of 25° and swung on a bed frame by hooking the mesh over one of the bunks. Underneath there was a portion corresponding to the position of the buttock which could be let down, allowing dressing to proceed without moving the patient. The feet were fastened in this way by the weight of the body, both limbs being widely abducted. Patients are said to very readily accommodate themselves to having their head lower than their feet. They were very fond of b. i. p. (bismuth-iodiform powder). They stated that while they occasionally got iodiform poisoning from it and sore and swollen gums, they believed that in some way or other the duration of sepsis was lessened. Carrel's treatment was not much used, but it was employed to a certain extent. All of the officers repeated that the ideal was to close wounds by primary suture, or at least make an effort to get primary retarded, and this spirit pervaded everywhere.

We saw a guillotine amputation of the thigh, high up, performed for gas gangrene.

There was a ward for brain cases which was very interesting, as they received all the bad ones that lived.

One case was that of a young man in excellent physical condition who was brought in with what appeared to be a scalp wound. It was carefully examined, no fracture was detected, and after primary excision was sewed up, but in three weeks he began to be very quiet (we were cautioned to be suspicious always of a head case that becomes progressively quiet). Soon the temperature began to rise and localizing symptoms became evident. He was operated upon and a small fracture, which had been overlooked but was not depressed, was discovered. He was trephined, the abscess was evacuated, and all symptoms disappeared.

Another case was seen in which there was a good deal of loss of bone and brain substance in the right posterior, upper quarter. The wound was cleaned out and closed. Recovery followed, with motion returning to the left hand, which had been lost previously, but there was loss of sensation still.

The third case was an exceedingly bad one, in which a large portion of the bone from the occipital and posterior parietal regions was involved. In this case severe infection followed and the man's life was despaired of, but he gradually improved physically and the infection was overcome. A brain hernia now developed that was cut out, and an osteoplastic operation was done; but as in all of these very severe cases the man is a perfect dement—his mind is permanently gone. Most of their brain cases were doing very well and, strange to say insanity does not seem to be a frequent sequela.

The wounds of the chest were almost universally recovering, but there was one case, that of a young boy not over 18 years of age, who had just received the Victoria Cross for distinguished bravery, and who was hit just as he was swinging on his pack to return on leave. He was a high-strung young man and, by one of those paradoxes of psychology, was very much alarmed about his condition. As a matter of fact he had a right to be because there was evidently some infectious process going on in the chest, his breathing was rapid and his temperature had risen.

When we left the hospital we stepped out into the large park surrounding the monastery to inspect the contagious-diseases camp. This was situated under some magnificent trees and was the most attractive place we have yet seen, the character of the grounds being in accord with the English custom. In this place the marquee tents were correctly pitched according to military custom and ample air space had been allowed between them. They were well heated, well furnished, and well cared for. All of the tents were being sandbagged and bombproofed, and dugouts were being built, as a casualty clearing station, only a few miles away, was raided a few nights ago and nine nurses and some orderlies were killed.

The infectious diseases-hospital had quarantined their cases in tents and groups of tents, by diseases. The prevailing infectious disease was mumps, and they complained very bitterly of it because they were obliged to keep a man 21 days before returning him to duty. They stated that there was a great deal of orchitis following this affection. They retained their scarlet fever cases generally, but they sometimes send them back to another hospital. They had a fair number of cases of measles. The medical officer stated that the old type of measles was ever present and was very bad, the usual complications being mastoiditis and bronchopneumonia. They had some cases of inflammatory rheumatism and gave a very unfavorable prognosis. They treat very few cases of diphtheria or cerebrospinal meningitis.

Army Sanitary School No. 37.

VISIT TO 11TH DIVISION DEPOT MEDICAL STORES, DIVISION BATHS, CORPS LAUNDRY, AND INSPECTION OF FIELD AMBULANCE EQUIPMENT

The advance medical supply depot was in the same town in which the casualty clearing station, in which we were quartered, was situated. It was in an old brick building with the windows all shattered from avions. Cold, neat, and cheerless. Supplies are furnished divisions and issued on indents (requisitions) from R. A. P., A. D. S., C. C. S., with approval of the D. D. M. S. Articles issued are automatically replaced from base depot. There is a room full of drugs, another with dressings, instruments, and complete chests of medical supplies, and still another with splints, oxygen tanks, nitrous oxide gas, etc. Most of the splints were of the modern Thomas type, but they had a large supply of all kinds of the old splints used previous to the extension method. They said that these splints—especially fracture boxes—were hardly ever called for. While this is a corps organization, the English Army provides for a divisional advance medical supply depot. There is no accountability in the transactions with front and rear. It takes a week to fill requisitions. The bandages noticed were of 2, 3, 4, and 6 inch widths. The English refer to absorbent cotton as "wool."

BATHS

This was at division headquarters, a half hour from the town at which we were quartered. The division baths in the English Army are under the A. D. M. S. and are run, in this particu-

lar instance, by the field ambulance stationed in the town where their headquarters were. There was a complete service for bathing, disinfection of clothing, and supply of clean clothing. All companies are bathed every 8 to 10 days and it is a military function; they come in a body. The bath in question was situated in a tumble-down house of this tumble-down town and it was wet, cold, and uncomfortable, but the baths were there all the same. There was a room for undressing, from which we passed to the bath and then to the dressing room. When the men stripped, their underclothes were all thrown in a pile to be carried off to the corps laundry the next day. Their outer clothing, except their shoes, was put in the hot-air sterilizer outside the building, to be deloused. If they brought a towel the towel was thrown in with the dirty clothing, as they were furnished here towels and soap. They then passed to the bathroom where they got under the hot shower bath. Then they passed to the dressing room where they were given clean underclothing from the general store and handed their disinfested outer clothing. The whole operation took about 20 minutes. The sterilization of the outer clothing was accomplished at 200° for 20 minutes. There was a Thresh sterilizer working here which was used chiefly for blankets, which is the chief source of scabies, and this did not seem to be used for underclothing at all. The hot water for the baths comes from the two boilers, and there is a separate bath for officers. They can put in 600 uniforms in their hot-air sterilizer in an hour. The disinfestation of the outer clothing was accomplished in a dry-heat room, improvised, as usual, with corrugated iron, through the floor of which ran, exposed, a flue which turned up in a stack at the end. It was pretty well air-tight. The fire was kindled outside and burned a great deal of coal. It was very hot. They kept a temperature of 200°. They said that 500 men could be bathed a day. The whole plant burns 1½ tons of coal a week for bathhouse and delousing. One R. A. M. C. corporal is in charge and he has five Army Service Corps men on duty under him. The Thresh puts through 50 blankets every 30 minutes, and stories vary as to the number of blankets they can do in a day—some say 1,000 and some venture 2,000. The blankets are steaming when removed to dry. They stated that they steam the blankets of the entire division every three weeks at the rate of one regiment a day. If they find scabies in a billet they take out all the blankets for delousing and issue fresh ones.

Walking a short distance away to a very much overbombed house, we entered the division canteen. Back of it, in a big room, was the division soup kitchen. There are three Soyer stoves here for hot soup and tea, and the man on duty was required to have hot drinks free of charge for all men who applied for them, night or day. This worked very well. Companies on the way to the trenches at night were served here.

Farther on we visited some of the billets. The town is just on the edge of falling down entirely from the nightly visits they receive, so the billets were not much. Most of them were badly ventilated, overcrowded, dark, and poorly furnished, with improvised bed frames made of old pieces of lumber and chicken wire, but it was the best they could do under the circumstances. It was a dingy town and very sad looking, but the men were the picture of health.

We now visited the field ambulance which runs the baths, where we found laid out in a room the entire equipment for a field ambulance section, with all the chests, panniers, and boxes open. It did not differ very materially from our own except in the following regard: Three small tents, three Primus stoves. They had a good many more blankets. Their field-going equipment was more liberal, and they had ovens of the kind described heretofore as being put into an improvised range at casualty clearing stations. They had a basket devoted to rubber goods only. Everything was neat and clean.

CORPS LAUNDRY

The corps laundry was immense, and poor. It looked like a ruined sugar mill and was about the same size. Everything practically was improvised and in certain parts there were pieces of modern equipment, like centrifugal tubs, which gave the impression of mahogany tables in a dugout. The laundry was in charge of a lieutenant colonel, and he was very unhappy. Said they wouldn't give him anything. He said he hoped the United States would start right because he wouldn't like anybody to have his troubles. He said the little machinery that he had only made him dissatisfied with the rest of it.

In the first place, the approach was over an awful road, muddy and filled with big stones. The laundry comes from the divisions daily and is thrown in a pile and counted. The driver is given a receipt which he takes over to the cleaning side and gets exactly the same number of pieces in exchange for his receipt. They take this laundry and immediately sterilize it in a double Thresh apparatus, and it is then washed, some in steam mangles and some by civilians (women) who were improperly housed and in a room filled with dirty clothes and streaming steam. A few centrifugal machines were seen. The clothing from hospitals is, in addition, sulphurized. Finally, when washed and dried, it is mended by an odd crew of women, done up in bundles and stored ready for issue. This laundry was the essence of overimprovisation; a good laundry would have cost much less to run and been far more efficient. It must be said, however, that the demonstration was really wonderful, as they actually made the thing work efficiently. It washes for 25,000 men. Two thousand sets of underwear can be sterilized and dried daily. There is an ironing department run by women. The drying room is large and new. They have cages in compartments which are heated by flues which pass around the room before they leave it. They are entered by tight-closing doors and have only a pipe for the escape of steam from the drying clothing. The steam laundry has to be up and going, as the division needs daily 5,000 pairs of socks and 2,500 units of clothing—shirts, drawers, undershirts, and towels.

I went away with a tremendous respect for the officer in charge, who had made a success out of a really insufficient plant.

FIELD AMBULANCE

The last place we visited was the rest station manned by the First North Cumberland Field Ambulance, 46th Division, in the town in which we were quartered. Here all cases of suspected self-inflicted injuries were sent for observation and investigation. One section of the field ambulance equipment was taken out and loaded on a wagon, which required four horses. To the wagon was attached a trailer which weighed 4,500 pounds. It was under the command of Colonel Writh. The wagon contained, among other things, when loaded, one acetylene outfit, medical comfort panniers, one food box, one operating table, and one fracture box, which had never been opened and in which the fracture mobilizing outfit was completely out of date, but they lug it around just the same.

The hospital was neat, especially the quartermaster's storehouse, which was really a commissary. Food was usually replenished there. The kitchen was excellent, and by the conservation of fats they got 70 pounds in two weeks to turn in. The grease traps in the kitchen alone yield $3\frac{1}{2}$ pounds a day.

Army Sanitary School No. 39.

VISIT TO SCABIES HOSPITAL AND CORPS REST STATION

This hospital was in huts and received all parasitic skin diseases. On admission the clothing is taken away and sterilized. The man is bathed and anointed with sulphur ointment and put to bed. This sulphur ointment is kept up for three or four days. He is then bathed and left three or four days without any treatment. If the infection still persists the treatment is repeated. If there is any inflammation of the skin he is treated with bland ointments, such as zinc oxide, 10 per cent; also use ammoniated mercury. The outer clothing is sterilized in a dry, hot-air sterilizer at 220° F. for half an hour, and this is repeated if the man stays there any time. A fair dermatitis is set up by overuse of sulphur. Scabies is one of the great causes of incapacitation of the soldier. It was extending throughout the army pretty rapidly. One of the complications of scabies which is counted serious is impetigo.

The scabies hospital here was a stationary hospital once. It is generally in Nissen huts and buildings—all well heated and lighted. The beds are improvised from frames and chicken wire. The hot-air sterilizer was the same as that used at division baths, already described. The kitchens were good and the grease trap was in use. The latrines were of the pail variety. The incinerator was brick.

Men to be discharged are always sent to the evacuation ward the day before they go out.

Tubs are used for bathing, which seems to be an error as if bathing at any place requires a shower bath this is the place for it.

CORPS REST STATION

The corps rest station used to be a divisional unit, but is now provided at the rate of two per corps. The cases sent here are those of the slightly sick and men who are worn out by overwork and need rest and sleep. The cases are received direct from the A. D. S., M. D. S., or C. C. S. At certain times slightly wounded are also sent here, as well as convalecents from all units, who will be able to return to the line in four weeks. The commander of the field hospital was a very experienced officer and said that he believed that at this place men should be allowed to take it easy and be freed from as much military routine as possible. He said that it was a place for them to forget about the war. He added that two days ago a bomb had struck the place and killed 4 and wounded 14. The exact capacity was not stated, but we understand it ran from 300 up and could expand even to 1,000. It was run by a field ambulance detailed in sequence from the division. The equipment came from the Red Cross chiefly, but there were some quartermaster's supplies. Medical and surgical supplies were furnished from the equipment of the field ambulance. When an ambulance was relieved it only took with it its own equipment; other supplies remain here. The object of the station is to save wastage to the division, which would occur if the men were sent farther back. At this hospital they also receive cases of trench foot and a great deal of P. U. O. (pyrexia of unknown origin, known more commonly as trench fever). No surgery was being done here. The treatment consisted of rest, recreation, sports, forced feeding, and open air. They tried to make the men forget they were soldiers and free them from war. In this way many men are prevented from getting sick who would otherwise break down if they kept on. About 80 per cent go back to their regiments in two weeks. They rest from three to six weeks, but some have to be sent eventually to a stationary hospital. Gas cases go to a special casualty clearing station for treatment, but the general causes of admission are coughs, fevers, and trivial wounds and disorders. One of the chief objects aimed at in this hospital is to provide a quiet, pretty, well-kept place, with good grounds, and they have succeeded. The police and neatness of the place is on a par with what has been said of other English medical stations. There is really room for 500 patients here in cosy, well-lighted huts. The whole object of the medical officer seems to be to make the men comfortable and give them plenty of entertainment. Amateur theatricals enter into this, and they have a very nice assembly hall for it. They also have a barrack building devoted to amusements, with carpeted floor, comfortable wicker chairs, writing material, and games. Bridge parties were quite the rage at this station. A number of pictures were seen on the wall of considerable merit. At the time they were making great preparations for Christmas, and a big theatrical entertainment was being planned. There is a gymnasium in another building, and the men were encouraged to take part in outdoor sports. The pail system of latrines, with incinerator and soakage pit, was in vogue here. The kitchen was excellent. The dining room was well decorated. There were the usual canteen, library, carpenter shops, barber shops, etc., and the place was self-sustaining. Much construction work was being done here by the men themselves.

The organization was $\frac{1}{3}$ No. Midland Field Ambulance, in command of Col. F. A. Hodders. Colonel Hodders explained that the slightly wounded usually go to the division collecting station.

Army Sanitary School No. 41.

DUGOUTS

Lecture by Captain Irving, February 16, 1918

CLASSIFICATION

The term "dugout" includes all varieties of shelter of whatever kind that involve excavation and the provision of overhead cover against enemy fire.

The deep underground excavations made by actual mining operations, and from which the natural overburden has never been removed, are known as cave shelters; the relatively superficial structures made by first digging an open cut and later providing a shell-proof roof, as cut-and-cover shelters; and the small splinter-proofs used in the front line for the protection of one or two men, as individual shelters.

LOCATION

Cave shelters are now generally prohibited in the first continuous trench facing the enemy, whether it be a fire or observation trench. It has been found—

(1) That the difficulty of knowing the exact moment of the passage of a creeping barrage frequently causes men to remain in them too long; and as the exit from them is slow, troops are frequently trapped in the shelters and either killed or captured.

(2) That they concentrate troops together in too large units to permit of all of them reaching their positions in line sufficiently quickly to take part in the defense against attack.

(3) That it is difficult to prevent troops, whose presence above ground is imperative to repel an attack, from taking shelter in them during preliminary shellfire.

Cave shelters become progressively less numerous and larger from front to rear since the farther the shelter is from the front the longer will be the time available for exit and deployment and the less will be the likelihood of sudden attack. It should, however, be borne in mind in locating back-area shelters that any line of trenches is liable to become a front line in case of retirement. Shelters should therefore always be so located and constructed as to be convertible to use under such conditions.

The entrance to cave shelters may be from a fire trench, from auxiliary trenches in the rear of the fire trench, or from naturally sheltered localities such as steep reverse slopes, old quarries, etc.

Entrances must invariably be placed so as to permit of easy passage from the shelter to the places where the occupants are to become effective.

Cut-and-cover shelters are located in or near the front line where cave shelters are prohibited or in localities where ground water, hardness of rock, or other causes make the construction of cave shelters impracticable.

Individual shelters are of light construction and are placed only in or near the front line.

CAVE SHELTERS

Necessity.—Cave shelters have become necessary in modern warfare on account of the increase in the duration of battles and the development of artillery of heavy calibers, while their construction has been made possible by the stabilization of opposing lines through long periods.

Troops must now frequently remain under shell fire for days and often weeks at a time and require rest, sleep, and relaxation from nervous strain. These are possible only when complete protection against shell fire is afforded. This protection must not only in itself be actually sufficient but must be one in whose adequacy the troops have implicit confidence. Without such protection the physical fitness and morale of troops can not be preserved.

Attacks occur only at intervals, but the occupancy of the cave shelter is continuous. Therefore maximum comfort consistent with proper protection must be secured for the inmates, comfortable bunks must be erected, water and dampness excluded, ventilation and proper sanitation secured, light furnished, and as far as possible space for the storage of personal effects and for amusement and relaxation provided.

Standardization.—A standardization of dimensions and structural materials is essential in order to—

- (1) Prevent the erection of unsuitable shelters by unskilled men.
- (2) Relieve supply depots of the necessity of preparing and keeping in stock a very large variety of different materials.
- (3) Establish a uniform system which may be readily learned and taught to a large number of men.
- (4) Insure the rapid provision of an abundant supply of materials.
- (5) Secure maximum economy of materials.
- (6) Minimum labor at the front.

The standards adopted are stated in the appropriate places under each of the following paragraphs dealing with particular portions of a dugout. They have been made sufficiently elastic to be applicable to a wide variety of conditions.

Cover.—The amount of cover required by a cave shelter depends upon the caliber of the artillery against which it is desired to provide protection, the explosive charge contained

in a shell of given caliber, the character of fuse employed to produce detonation, the depth of penetration before explosion, the nature of the soil or rock overhead, the extent to which the soil has been previously subjected to shell fire, and to a limited extent on the nature of the interior construction. The calibers in use by the enemy include the following.

37-mm. (1.46-inch) revolver gun.	150-mm. (5.89-inch) heavy field howitzer.
76-mm. (2.95-inch) light trench mortar.	170-mm. (6.69-inch) medium trench mortars.
77-mm. (3.03-inch) field gun.	210-mm. (8.30-inch) mortar.
88-mm. (3.45-inch) field gun.	240-mm. (9.45-inch) heavy ladungswerfer.
92-mm. (3.58-inch) Lanz trench mortar.	250-mm. (9.84-inch) heavy minenwerfer.
100-mm. (3.94-inch) gun.	305-mm. (10-inch) howitzer and gun.
105-mm. (4.13-inch) light field howitzer.	380-mm. (13.96-inch) gun.
120-mm. (4.73-inch) gun.	420-mm. (16.53-inch) mortar.
130-mm. (5.31-inch) gun.	

Of these guns the very heavy calibers, 305's, 380's, and 420's are not in common use, their transport and emplacement and the transport of ammunition for them offer extreme difficulties, and their manufacture in large numbers is impossible. They are therefore rarely employed unless the objective be a strong defense of some point which must be passed at all costs, a bridgehead or some vital and strongly defended obstacle. Such circumstances are rare, and when they do arise cave shelters of great depth must be made which will afford suitable protection against them. The following table will give some idea of the great depth of penetration and the extreme destructive effect of these very heavy caliber projectiles in ground consisting of earth mixed with pebbles.

Caliber	Explosive charge	Thickness to be given to the roofs of dugouts	Depth of penetration	Place of the experiences
		<i>Kilograms</i>	<i>Meters</i>	
210 (high charge)	18	6.50	3.00	Verdun.
305	35	8.50	4.50	Do.
380	68	8.50	3.50	Do.
420	106	14.50	8.75	Do.

Shelters deep enough to withstand the destructive effect of the last three very heavy calibers (305, 380, and 420) can be made only with great difficulty and require the services of skilled engineers. They may be regarded as a special job and should not properly be included in normal dugout work.

It is therefore clear that the amount of labor involved in constructing all cave shelters so as to furnish protection against them is not justified.

Of the first 14 or smaller calibers shown in the first table a few only are in common use, and it is for protection against them especially that necessary cover must be provided. These are the 77-mm. field gun, 105-mm. light field howitzer, 150-mm. heavy field howitzer, 210-mm. mortar.

The 210-mm. mortar shell is of two different varieties, that with a light charge and that with a heavy charge of 18 kgs. of high explosive. The heavy charge shell has a weight of 262 pounds, and a depth of penetration of from 9¼ feet in hard rocky ground to 11 feet in pebbly earth. Since both the charges and the penetration of the 210-mm. mortar far exceed those of the lighter calibers and its trajectory is so high as to permit of the maximum effect on cave shelters, it is clear that cover sufficient to furnish protection against it will likewise be much more than sufficient against the lower calibers. For these reasons it has become customary to consider protective cover in terms of the high-charge 210-mm. shell.

The 210-mm. shell is made both with an instantaneous fuze and a delay-action fuze, and it is the latter type which is especially used against the cave shelter.

For both classes of fuze, a layer of hard rock, broken brick, coarse gravel, concrete blocks, rails, logs, etc., covered with only a thin layer of earth and placed directly over the point to be protected, adds materially to the strength of the dugout since it causes the detonation of the shell nearer to the surface. When this hard layer is artificial it is termed a burster course.

The theory of the burster course is simple. The detonation of shells is brought about by their sudden retardation. Any such retardation of an instantaneous fuze produces immediate detonation so that no appreciable penetration can occur after retardation has taken place. In soft ground this retardation does not occur until after very considerable penetration. The shell therefore explodes below the surface not only at a reduced distance above the cave shelter chamber but with a much increased destructive power due to the tamping effect of the penetrated earth.

A burster course, though not opposing any appreciable obstacle to the passage of the shell, produces retardation nearer the surface and so prevents penetration and the consequent increased destruction.

With the delay-action fuze an appreciable delay occurs between retardation and detonation and thus permits a considerably greater penetration after retardation and before detonation. Consequently the delay-action shell will always penetrate deeper than the instantaneous, even when a bursting course is interposed, but for this very reason it is extremely important to produce retardation at the surface and thus to restrict the penetration after retardation to the space between the surface and the point of detonation.

Since a burster course can not generally be placed over a dugout chamber, but only above the entrance, care must be taken whenever possible to select ground where there is a natural burster course; i. e., ground that contains a hard layer of rock, not more than 16 inches below the surface.

The nature of the soil which forms the overburden materially affects the depth of cover necessary. Sodden, shell-plowed earth is the poorest of all covers and requires the greatest depth. Since it does not generally extend much more than 15 feet below the surface, it will usually form only a portion of any given cover. In such a case it is worse than nothing, for it so tamps the explosive that it renders insufficient the remaining cover even though the latter would otherwise have been sufficient. Next to shell-plowed earth, soft unturned earth, whether clay or loam, requires the greatest depth, chalk less depth, limestone still less, and very hard rock such as granite the least of all.

The following figures give minimum head cover for protection against the 210-mm. shell:

Sodden shell-plowed earth, upward of 30 feet (9 m.).

Soft unturned earth or loam, 23 feet (7 m.).

Chalk, 21 feet (6.4 m.).

Limestone and marl, 20 feet (6 m.).

Very hard limestone, 12 feet (3.7 m.).

Granite, 6 to 8 feet (1.8 to 2.4 m.).

Shelters are rarely made in granite or rocks of equivalent hardness, so that they need not be here considered. It is the practice of the French to place their cave shelters between 6 and 7 m. as a minimum, according to the character of the soil. The British go deeper and now generally consider 29 feet as the best practice both in earth and chalk.

While the minimum depths above given may perforce be employed when the ground water level is high or shortness of time and hardness of rock preclude the possibility of deeper work, it is now considered important to secure a cover of from 25 to 30 feet. The added excavation affects only the narrow entrances and involves but little added work, which is far more than compensated for by the increased security.

The timbers used in the interior construction of a cave shelter and the arrangement of chambers must be strong enough not only to support the ground but withstand the destructive force of high-explosive shells. For such depths as 25 feet or more, lighter timber is required than for shelters nearer to the surface, since the force of shell shock decreases much more rapidly with depth than the need for added support increases.

The size of underground chambers has some effect on the cover requisite for safe protection. Stronger support or deeper cover are necessary for large than for small chambers. It is therefore necessary to limit the size of chambers. The maximum span of cave shelters is limited by the available material employed in construction. Under ordinary conditions this span should not exceed 9 feet since timbers of sufficient size for greater spans are difficult to secure and structural steel girders must be too long and too heavy for easy transport.

INFANTRY CAVE SHELTERS

General plan.—A cave shelter consists of a number of relatively narrow entrances connected by galleries and chambers. Chambers furnish living quarters for the garrison. The arrangement of chambers, entrances, and galleries differs to some extent, according to whether they are designed to house Infantry, posts of command, Artillery personnel, machine-gun crews, or surgical dressing stations.

Cave shelters for infantry are made up of standard units, each unit to house 24 men. Each unit comprises a longitudinal chamber connected at opposite ends by galleries, with at least two entrances. Chambers are 9 feet in width and either 33 or 35 feet in length from wall to wall. These dimensions should not be exceeded.

Two standard units, joined together, will house 48 men or an Infantry platoon, with a 9 by 9 foot separate room for the platoon leader. The general plan for enlisted men, 10 will be detailed on special duty as cooks, orderlies, buglers, cyclists, liaison agents, etc., so that there will never be more than 48 men in a platoon shelter at any time nor more than 24 in a standard or one-half platoon units.

Larger shelters for companies, battalions, etc., are built up of these standard units by adding one to the other until the desired size is attained. The maximum number of men using a single entrance in a disconnected one-half platoon unit is 12, in a platoon shelter of two units, 16, and in a series of three or more connected units it is as high as 24, but it should never exceed this figure.

At the bottom of each entrance is a winze which forms a bomb pit, placed to catch grenades thrown into the entrance so that they may explode in it without injuring the occupants. It is also designed to catch mobile charges of from 10 to 20 pounds of high explosive rolled down the entrance, and should be made deep enough (at least 8 feet) to reduce the concussion to a minimum. This bomb pit is extremely important and should never be omitted from those shelters which are far enough forward to fall within range of raids or sudden attacks. To still further reduce the destructive effect of explosives, a right-angled bend or elbow is made in the gallery just before it joins the chamber. This causes a number of reflections of the wave of concussion before it enters the chamber and reduces its effect. The number of reflections is still further increased by excavating the chamber on the side of the gallery toward the mouths of entrances instead of away from them.

The commanding officer's chamber should always be built on the same plan as the main chamber where the men are quartered in order that it may be later expanded into a full-sized chamber in case it is desired to add another unit to the shelter.

In Infantry cave shelters designed for reserves the bomb pit and elbows may be omitted if desirable since the shelter is far enough in the rear to render attack extremely unlikely.

The width of the block of ground or pillar between each entrance and the adjacent chamber may vary in accordance with distance apart at which the entrances are placed, but it should never be reduced below 6 feet. Wherever possible it should have the width shown on the type plan (9 feet 4½ inches), since the greater width removes the chamber farther from the explosives in the bomb pits, affords a greater number of reflections to the wave of concussion, and furnishes a safer support to the ground between entrance and chambers.

On the type plan the two entrances of a unit cave shelter are spaced a number of feet apart, center to center. A uniform spacing of entrances can not, however, be adopted since topography, the position and relative length of traverses and the location of favorable surroundings may compel a considerable variation. Any variation from the spacing shown with type plan will be taken care of by expansion or contraction in the length of the gallery leading from the foot of the incline to the chamber, provided only that the width of the block of ground or pillar between entrance and adjacent chamber be not reduced to less than 6 feet. When the change in spacing of entrances is equal to the spacing of two gallery sets an additional set is added or subtracted from each of the two galleries connecting the two entrances and the chambers. When it is less or more than 6 feet the desired increase or decrease in length is provided by introducing closely spaced sets in the same galleries until the desired spacing is obtained.

The recessed type of cave shelter where successive rooms give off of one main gallery connecting the entrances should not be used for Infantry because the large number of men quartered in a single chamber renders satisfactory ventilation difficult.

STANDARD MATERIALS FOR GALLERIES AND INCLINES

Gallery sets.—Gallery frames are so constructed that they are of sufficient strength to serve both as frames and as eases. The uprights at the sides of the gallery shall be termed the posts, the cap sill at the top the cap, and the ground sill at the bottom the sill. When assembled the posts, cap, and sill of a single unit shall be collectively termed a gallery set, or simply a set.

Caps, sills, and posts are made of 9 by 8 inch softwood plank. All joints are solid butt joints. Posts are kept in position by 1-inch boards (—or 8 inches in width) called spreaders and nailed to the caps and sills as distance pieces. The use of the spreaders obviates the special framing of timbers for joints and permits caps and sills to be converted to any other desired use by the simple removal of spreaders.

Spreaders are nailed onto caps and sills before the latter are shipped to the front. Three small nails only are used so as to permit easy removal for correcting errors in cutting or for converting plank to other uses.

Gallery sets for cave shelters are of two different sizes, a smaller size for general use and a larger size for special. Standard gallery sets are used for timbering inclined entrances to cave shelters, where the timbers are set normal to the slope, for horizontal galleries connecting the bottoms of entrances with chambers, and for horizontal galleries used as third entrances. They are also extensively used for the closely timbered galleries employed on a large scale in mine warfare.

The special set is used for supporting the fire step when inclined entrances give off from the fire trench and for timbering those inclined entrances in which it is necessary to place the sets in a vertical position. It is sometimes employed for closely timbered Infantry subways.

(1) The small set is 6 feet in the clear from spreader to spreader by 3 feet in the clear between posts. Posts are 6 feet 2 inches long, caps and sills 3 feet 6 inches. The standard small gallery sets are made from 6 inch to 8 inch round logs 10 feet in length. Logs are first sawed in two lengthwise, then crosswise, so as to yield two posts 6 feet 2 inches in length and a cap and sill 3 feet 10 inches in length. They are then set with the flat faces inward and separated by the usual spreaders. The additional 4 inches in length of cap and sill forms a projection beyond the posts necessary on account of the decreased bearing space caused by the half-round logs and their variation in size. This type of set is not so strong as that made by squared timber, but is economical and in many cases is quite strong enough.

(2) The large set is 6 feet 4 inches in the clear from spreader to spreader and 3 feet in the clear between posts. Posts are 6 feet 6 inches long; caps and sills 3 feet 6 inches. In exceptionally hard, unfissured rock formations it is sometimes possible to place sets at 5-foot intervals, center to center, but this so reduces the factor of safety in resisting shell shock that it is generally inadvisable and should never be done without expert advice.

In exceptionally heavy ground it may sometimes be necessary to use heavier sets than the standards above noted. Under such circumstances the services of skilled engineers will be necessary, and special timbers will be separately ordered and cut as needed.

Sprags.—When gallery sets are spaced at intervals on inclines of more than one-fourth, which will frequently be the case in firm rock formations, sprags or distance pieces are placed between successive sets so as to catch up the posts and caps and prevent the sets from being overturned. These are 9 by 3 inch plank, 2 feet 3 inches in length. On these rare occasions when sets are placed at 5-foot centers, sprags are 4 feet 3 inches in length.

Sprags are to take up the strain on the cap sills. They are not to be framed or jointed, but simply fastened by toe nails to adjacent post and cap. Sprags are not necessary in horizontal galleries except in sets at the bottom of an incline, where they are extremely important in order to take up the strain transmitted through the successive caps of the incline.

Lagging.—To hold the ground between the posts at the sides of the gallery and between the caps at the top, lagging is placed behind and above the sets. Side laggings may be overlapping and is then driven in the same manner as spiling, or may be put in position so that the ends of the boards meet behind the posts or over the caps. When the roof lagging is driven it is usually sharpened and is then termed "spiling." Side lagging is of 1½ inch plank

of from 4 to 9 inches or more in width, according to the sizes most readily available. For sets spaced at 3 feet center to center it is 3 feet long. When driven it is 3 feet 9 inches long to allow for overlap.

Spiling boards and roof lagging are of 2-inch plank 5, 6, 8, or 9 inches in width, according to lumber available. The larger widths are less desirable, as they are more difficult to drive. Spiling boards are 3 feet 9 inches long or 5 feet 9 inches long, according to the spacing of sets.

Stair stringers.—When sets are placed normal to the slope in cave shelter entrances on a slope of more than one-fourth, stairways must be made to facilitate exit. Stair stringers will be made of 2 by 9 inch plank of commercial and readily transported lengths. Cleats 2 by 3 by 9 inches are nailed on for steps. Cleats are always to be attached before stringers are set, since difficulty is experienced in placing them properly in the constricted space of the entrance.

Steps have a 9-inch tread and a 9-inch rise and are made of 2 by 9 inch plank cut in 2 feet 9 inch lengths. They are nailed to the cleats and act as additional spreaders, and so materially strengthen the entrances.

STANDARDIZED MATERIAL FOR CHAMBERS

Chambers.—Chambers are supported by chamber sets extending crosswise of the chamber. Sets consist of two posts capped by girders whose clear span must not exceed 8 feet. These sets are separated 3 feet center to center. The posts are best made from 6 by 6 inch sawed timber 6 feet 6 inches in length. Sills need not be used, but instead the posts are set 6 inches in the ground to prevent their slipping inward. In soft ground, such as clay, blocks of 2-inch plank, 8 by 12 inches, should be placed beneath them to prevent them from sinking into the ground. Where sawn timber is not available, which is frequently the case, round posts may be substituted. They are in frequent use by the British and furnish quite sufficient support if not too widely spaced. They should not be less than 6 inches in diameter at the smaller ends.

Caps should be made from **I** beams of rolled steel wherever possible, since these have greater elasticity than equivalent wooden girders capable of supporting the same static load and return more readily to their original form after shell shock. Wood subjected to the same shock will often splinter and break. **I** beams should be 5 by 3 inches and 11 to 12 $\frac{3}{4}$ pounds to the foot. They should have a length of 9 feet and are designed for a clear span of 8 feet. They should be placed so as to bear on the posts for a full 6 inches and should never be placed only part way across the tops.

When **I** beams are not available, caps may be made from 6 by 8 inch by 9 foot sawn timbers set on edge or from two 9 by 3 inch by 9 foot planks nailed together and set on edge.

When **I** beams are used a cast-iron shoe is placed between the **I** beam and the post. This has a flange against which the beam rests on the upper and outer edge and another on the inner and lower edge which extends downward and engages the inner side of the post. This prevents the post from slipping inward and keeps the girder from biting into the post and splitting it and at the same time turning over.

When shoes can not be obtained, an 8 by 1 inch soft pine block is placed between the post and girder with a 5-inch strip of $\frac{1}{4}$ inch sheet steel beneath the wooden block. The ends of this sheet steel are bent at right angles into an **E** shape, the outer one upward and the inner one downward so as to exercise the same function as the cast-iron shoe. Clips shrunk on hot are sometimes employed for the same purpose, and are widely used by the Germans. Angle irons bolted to the **I** beams are also sometimes used, but the labor of placing either of these is in general prohibitive.

In addition to the lateral posts, a second row of intermediate posts is set lengthwise of the chambers on the side where the galleries enter; these posts are 3 feet center to center from the posts at the side. These lend additional supports to the caps and serve to support the foot boards of the bunks. Except in very heavy ground they need only be placed at 6-foot intervals beneath every alternate girder. In hard rock formations they may be omitted. They should not be placed in 9 by 9 foot chambers.

Two extra end posts are set at either end of the chamber to support the lagging of the end faces. These are set only 4 inches in the ground and are notched at the top so as to leave a 2-inch lip and afford an angle to receive the **I** beam.

The successive chamber sets are tied together by sprags into a compact whole. The sprags at the sides are made of 9 by 3 inch by 3 foot planks, notched so as to engage both the web of the girder and the post, and are merely driven tight in and not nailed. Similar sprags are placed between the posts at the ends of the chamber immediately beneath the girder, but in this case they are nailed into place by toe nails. The omission of these side and end sprags, even in square 9 by 9 foot rooms such as are designed for platoon leaders, in soft or even moderately firm ground soon results in the sets moving slightly until the entire chamber timbering is awry. They are very important and should in no case be omitted.

Additional light 2 by 4 inch by 3 foot sprags are driven in tight between the webs of the I beams of successive sets. They are not put in place until the chamber is finished, as they interfere with the placing of the roof lagging or spiling.

The roofs of chambers are lagged in hard rock in the same manner as galleries. In bad ground they are spiled. Lagging is of 2 by 5 inch to 9 inch planks 3 feet 9 inches in length. Roof lagging in chambers should always be overlapping. The walls of a chamber between the posts of successive sets and at the ends are sometimes left bare in very good ground, but there is always danger of small pieces falling in ground that is blocky or in chalk. The latter is apt to weather after excavation and spall off. For this reason it is customary to lag all chambers tightly, and it vastly enhances comfort and sanitation to do so. If boards are used for the purpose, it is done with $1\frac{1}{2}$ by 6 inch to 8 inch planks. If the lagging be driven, the length is 3 feet 9 inches; if set, 3 feet. Expanded metal and corrugated iron are often used.

Army Sanitary School No. 43.

WAR SURGERY

By Surg. Gen. Cuthbert Wallace, December 17, 19, and 22, 1917

General Wallace introduced his subject by introducing himself as a sheep in wolf's clothing, because, as he says, "I am not a military man. He nevertheless stated that he believed firmly in the necessity for the strictest military discipline in the Medical Department to the end that good medicine and good surgery can be done, and that it can not be done without good administration, which is the skeleton upon which all professional success is hung. He sounded a very important note, however, when he stated that for the consulting surgeon he believed it necessary that results should be obtained by the personality of the man and an appeal to the reason of those he wished to direct rather than that his intervention should be by force of rank.

Men are taken directly to the C. C. S. as soon as they are hurt, irrespective of the time it may happen, if this is possible. The work at all stations in front of the casualty clearing station should be limited to purely emergency surgery. The system of evacuation of wounded in the British Army was officially changed in May, 1917. Previous to that time all the wounded were collected in one spot, and a motor convoy collected once a day in a body between 11 a. m. and 2 p. m. to remove them. Besides leaving men at the front long periods when they ought to be at the rear, the accumulation of this motor ambulance train at the front drew fire, with its natural results, and badly congested an already overloaded road. Nowadays two ambulances are kept at the A. D. S. and men are sent in as soon as hurt, and if there are many, the worst wounded are sent in first.

When a R. A. P. is in a fixed position it should be made as complete and as comfortable as possible for the work which it is to do. It is of highest importance to make a correct diagnosis and to employ the correct official nomenclature for wounds, and this means that it is necessary to have good surgeons at the front, and in order to get them you have to make them yourself if you want them uniformly good. It should be a principle that after having done everything that is necessary for a wounded man at the front, he must be let alone until he gets to the rear. Dressings should not be changed so often, not only because there is a loss of time and risk of infection, but because dressings are expensive and they are none too easy to get. So never remove them unless there is some special reason for doing so. Be gentle when you handle wounded men. Don't slam them around or pull off their

dressings roughly. General Wallace approves very highly, and prefers, the French system of having packages of sterilized dressings in the three sizes. In the English Army sterilized dressings for these stations at the front are sent up from the M. D. S. or C. C. S. In this army the Helby box is used, and although not as pretty and made out of tea and biscuit tins, it is useful as the sparkling nickel Schimmelbusch box. This box is made by telescoping a tea tin into a biscuit tin and perforating the two over two faces. In the sterilizer the steam enters the box and before it is taken out the outer box is given a quarter turn and replaced, thus preventing the entrance of dust. This box can be sterilized in the Thresh apparatus and is lined with gauze, which also covers the dressings packed in it. The gauze is cut up into 6-inch squares so that it can be lifted out by forceps in layers. Wet dressings are the best, in that they do not cake when put on the patient. You can send them in the marmites reserved for this purpose. These are generally white-enameled casseroles. To sterilize, you fill them up with dressings, pour on water, and boil; then you pour off the water and add an antiseptic.

At the front do not try to do anything more than remove gross impurities; the mud and dirt is cleaned away; the visible foreign bodies are removed if possible; and all handling, even to the point of cleansing the skin, should be done with forceps, the forceps grasping the cotton or gauze used for this purpose. This is because surgeons have to work rapidly in aid stations and in the A. D. S. and C. C. S. and are unable to sterilize their hands after each intervention. At every R. A. P. it is well to keep these forceps in a wide-mouthed bottle containing an antiseptic. It is well, also, to have a transfusion apparatus kept sterilized in a covered pot. When a man is evacuated always send your notes on the case and your opinion. Iodine and picric acid used on the skin can not be confided in as antiseptic. They can be used by anyone who has a taste for pretty colors. One-half per cent of picric acid in alcohol is the best way to use that drug. Do not do any meddling surgery at the front, and stop the tendency to do wildcat surgery anywhere.

In the Army some have a tendency to strafe the men in front of them. That is why it is necessary for the men in the rear to know something about the front. We should be able to visualize the difficult conditions under which a surgeon works at our front. We should remember that while good criticism is useful if it is not captious, we should not condemn the men in front unless the work is unquestionably bad. In the R. A. P. and A. D. S. make use of the triangular bandages as much as possible. They are rapidly applied, they make the best dressings we have for head and large wounds, and can be used satisfactorily in any part of the body.

It shows poor judgment for anyone to allow a patient to die in a motor ambulance. It rarely happens, but when it does the man responsible hears of it later. If a man can not make the journey safely, keep him at the forward station until he can. There are some cases of shock which should not be moved, and these include certain chest and abdominal wounds; but remember that operative dugouts are failures.

Here is another reason for a good regimental surgeon. No man should leave a C. C. S. or a M. D. S. with a tourniquet on, and if he is sent from the R. A. P. or A. D. S. with a tourniquet it should be placed in position but not tightened, so that the attendants in the ambulance can tighten it if necessary en route. As a matter of fact, the tourniquet should only be used as a last resort. Before appealing to it we should try digital pressure and good bandaging. But the application of a tourniquet, without tightening, is especially necessary before traveling in the dark. If you have to bandage a limb to arrest hemorrhage, it is better to place a splint on the off side and bandage up against it. Most trench orderlies and stretcher bearers have a great fear of a little blood, and think that a man is bleeding to death when it is merely the natural hemorrhage which ceases of its own accord.

General Wallace calls special attention to the vicious combination of powders and pastes used on fresh wounds, and an especially devilish combination is b. i. p., which is bismuth, iodine, and paraffin. It is dangerous because it not only gums up the wound but is absorbed, causing ulcerations of the mouth and also of the intestinal tract. The creosote paste he denominates the W. C. paste and says it blocks the wound up and does no good.

War surgery is life-saving surgery. Don't think you are going to be a fancy operator. What you need to be is a good scavenger at least.

By all means do not use antiseptics in war surgery if you can help it.

FRACTURES

Thomas splints must be of the largest size so that you can put them on over the clothing. When a Thomas splint is not available you can use a Liston, which is a long, wooden splint extending below the heel. They can be fixed with a triangular bandage. The Liston splint is also used where there is a wound of the buttock and a Thomas can not be put on. A fracture below the knee does not require a Thomas splint; here you may use a Nevelle's splint, but you must add some side pieces to it and the thigh end must be well fixed.

In fractures of the arm above the lower third of the humerus, put a pad on the axilla and put up in a Velpeau position or bandage the arm to the chest and support by a sling. These men should be transported in a sitting position, which is the most comfortable for them. Of course, in these fractures a Thomas splint can be used for the arm, a clove hitch being placed on the wrist, but it is not very satisfactory and pretty painful. One of the fine splints for the arm and forearm is the Gooch, which is a laminated splint on cloth. Fractures of the forearm should be put up in supination and with interior angular and short-sided splint. Additional support may be given by the wide ladder splint.

THE GENERAL TREATMENT OF WOUNDS OF THE SOFT PARTS

At the beginning of the war it was noticed at the casualty clearing stations that the *Bacillus aerogenes* of Welch and the streptococcus were our worst enemies. The Carrel treatment began in the English Army in May, 1916. Débridement was practiced first, and after that the Carrel irrigation, but now we are back to first principles—aseptic surgery, as reflected by the primary suture. Antiseptic surgery has failed. This primary suture was begun in 1917. The primary or primary retarded suture has now become the accepted method of treatment.

General Wallace said that in "peace times" 70 per cent of the cases passing through a casualty clearing station are operated upon, but in strife times 25 per cent is about all that can be put on the table. The rest may be evacuated to the rear. At such times as these practically all that can be done is a débridement and excision of dead or dying tissues, and detach fragments of bone, clothing, and foreign bodies.

OPERATIVE SURGERY

Don't go into this war thinking you are going to do brilliant operations, because that's the least of the work. By far the greatest number of all cases in a C. C. S. fall under the category of wounds of the soft parts and fractures.

WOUNDS OF THE HEAD

If you receive a man that has a wound of the head, try not to touch him for 24 hours if you can help it. A slow pulse does not necessarily mean a compressed brain that is being seriously compromised. It is probably due to concussion or edema and will clear up of itself shortly. As a matter of fact such cases should be sent to a special hospital back of the C. C. S., which is always best; such cases travel well before operation, and mighty badly afterward. In treating brain injuries turn down an osteoplastic flap and expose the dura so that you have an edge of at least half an inch of healthy membrane. Open the dura well and remove the dirt, spicules, clots, etc., under a gentle salt solution, and close, draining the angle of the flap if you feel like it. But it is best to close without drainage, performing a primary suture, because you can always open it again and drain it if necessary. Any embedded projectiles that are near the surface may be removed, but those that are deep should be left alone, after a short but intelligent search.

In closing up defects in the skull, bevel it so that you can slide over bone and cartilage to fill up.

The mortality of such head wounds as reach the hospital alive is 50 per cent, and a slow pulse should be considered a good sign. The most fatal cases are those that penetrate the ventricles, and wounds of the base are very serious. Wounds of the cerebellum are rare, but serious. A case with a pulse of 120 is not worth operating on. The syndrome of injury to the longitudinal sinuses is spasticity of the arms and legs. Do not operate on this latent

class of cases until the clot forms well in the sinuses. Epilepsy following head wounds is rare. Serious compression of the brain is better revealed by the general symptoms rather than by the pulse. Stertorous breathing and flaccid muscles are better diagnostic points. Brain cases will require at least two months rest if they live, and for this reason alone an operation should not be done at the C. C. S. Another reason is that after operation the noises of war disturb them very much. It should be taken as an axiom that fine brain surgery can not be done on the battle field. Don't talk about your end results until six months have passed. The decompression of the brain in skull injuries is not done as much as before. It is very interesting to contemplate that while the mortality from head wounds is 50 per cent, there are few cases of insanity or epilepsy following those serious wounds.

WOUNDS OF THE CHEST

One of the mistakes in this war was to delay aspiration of the hemothorax. Such aspiration is required, but it should not be done within 48 hours, and there should be enough blood in the pleura to bring the level high in front, extending to the angle of the scapula behind. The fear is that the blood will reaccumulate, but it don't. In any infusion into the chest—in fact in most chest injuries—the temperature rises sharply, rather highly, and descends slowly throughout five days. This does not mean infection ordinarily, but if the pleura is aspirated the temperature falls. Occasion should be taken under all of these circumstances to have cultures made for bacteriological examination. If the temperature doesn't fall promptly when there is a hemothorax, it generally means infection. The course to pursue there is to aspirate and get a bacteriological report. If the bacteriological report is negative, and the clinical signs remain, operate anyway. Wash out all infected clots. Do a toilette of the pleura and sew it up. In fact, except in streptococcus cases where the mortality is high, 33 per cent of these get well. If you have to reopen a chest that you have operated on for infection the second time, leave a drainage tube in. One of the curious clinical phenomena of anaerobic infection of the pleura is the facility with which such cases are confused with shock and hemorrhage. What happens is that such cases usually develop on a train, the moving incidental to the transport having caused the anaerobic infections to flare up, and diagnoses for secondary hemorrhage are made. Anaerobic infections of the lung are by no means uncommon and they cause severe pneumothorax. If you open pneumothorax cases at the site of the wound, do a complete operation, removing foreign bodies and close up by primary suture, because if you merely put in a gauze plug they may do well for a time, but later on they die of sepsis. In general, wounds of the thorax are very grave, but if a big vessel has not been opened at the time of the wound, causing death, the hemorrhage is not severe—often a little blood spit up is about all that you notice. Nearly all chest wounds are transportable with the exception of those with pneumothorax, and really should be evacuated, unless there is some special contraindication. Mistakes made in chest operations still come from delay in aspiration and plain bad operating. One of the objects of aspiration is decompression of the lung. Sometimes purulent processes are loculated and when you puncture the pleura for a specimen for the laboratory you may not hit the pus, and in this case you may have to be guided by your clinical sense rather than the laboratory. Another mistake made in this war was that of open or “sucking” wounds. They were kept open. In this case you should excise the rib, clean it up and close the wound. When these cases come in the R. A. P. or A. D. S. they must be transported. With every breath the man is alarmed by the peculiar noise and there is apt to be some pneumothorax with it. The proper procedure is to either pull the skin over it with a few sutures or plug it with gauze. This causes great betterment and the man can soon be transported to the C. C. S.

Whenever you do a thoracotomy and pull out the lung to operate on it—which should be done by resecting the fifth rib—pack gauze around it to keep the air from making the lung collapse by entering the pleura. Men with wounds of the apex usually die, drowned in their own blood.

For wounds of the lung requiring operation, try to operate within the first 48 hours if possible. In large wounds of the chest it is best to have the patient rest for about six hours before operation after reaching the hospital. A massive collapse of the other lung is generally fatal and is a contraindication for operation.

ABDOMINAL WOUNDS

In the Boer War operations in this class of wounds were failures, and this had a great deal to do with discrediting the opening of abdomens at the front; but they were failures because of the enormous amount of dust in that country, which covered and dirtied everything; on account of the shock from cold, because it was a very cold country; the delay in getting the wounded; and the lack of water. The operating theater was so far back that frequently the wounded did not reach it until 48 to 60 hours after having been wounded. In 1914 abdominal wounds were kept at the front as nontransportable, but we began to operate in the British Army in the field in June, 1915.

Rapid evacuations and post-mortems prove that neither shock nor peritonitis was responsible for the high death rate in the early part of the war, but hemorrhage. Bullet wounds are not as dangerous as shell wounds as far as their ability to tear things up in the abdomen is concerned, and it is true that a bullet can go through the abdomen without opening a hollow viscus. We must always look out for an abdominal wound when a man comes in wounded in the buttock, and such wounds are very fatal when they reach the abdomen from that source. The operation mortality of abdominal wounds is 51 per cent, and the raking wounds from side to side are most fatal. The worst are those that occupy a space to the right and above a line drawn from the lowest part of the ribs in front to the anterior superior spine and the ilium, and their fatality is generally due to hemorrhage. The most dangerous wounds of all are those that hit the midline of the abdomen. Two-thirds of the wounds enter from the front and one-third from the back. Wounds entering from the thorax and penetrating wounds of the liver are very dangerous. The general mortality in abdominal wounds is 80 per cent. A high pulse in abdominal cases is very unfavorable. Most of the wounds entering the abdomen from other parts than the front of the belly are from bomb and surprise attacks. The mesentery seems to be the last organ in the abdomen to be injured. The general practice in simple bullet wounds and small bomb and shell fragments is to let them alone. The incision to make in abdominal cases is a paramedian one, 8 inches long. The mortality from wounds of the abdomen entering the back is higher than those entering the front. The mortality of stomach wounds is about 50 per cent. Wounds of the fundus are extremely difficult to get at, and it is best to do a thoracotomy first and deal with such a lesion from above downward, incising the diaphragm to get good exposure. In wounds of the stomach the bleeding from the walls is not usually very great. In the fundus there are usually slits shaped like exclamation points—a long slit and then a point. In the greater curvature you may get a notched or V-shaped wound. Wounds near the pylorus may cut the stomach in two. Some of these stomach wounds recover well, but don't ever give food by the mouth. Use the rectum; it is better.

SMALL INTESTINE

As this organ is in folds, multiple wounds are the rule. The mortality is 65 per cent. Twenty wounds of the small intestine have been successfully sewed up. When you open an intestine, if the holes are small sew them up as you find them, and go on hunting; but if they are large clamp them off, cover them with gauze, and go on hunting somewhere else. Do not be too hasty or desirous to resect, and in single small holes do a purse-string suture.

LARGE INTESTINE

It is generally the transverse colon that gets it. But as the large intestine does not hang in folds, multiple wounds are not so common. They are, however, at the hepatic and sigmoid flexures. The descending colon is sometimes cut in half, and as a rule it is empty at the time. The mortality of such colon wounds as reach base hospitals is 46 per cent; in the early part of the war, before the operative period, it was 80 per cent. The colon wounds reach the base more frequently than any other kind. If you have to intervene with the colon make a loin incision, which should be transverse. Colon wounds should be drained.

RECTUM

Posterior wounds of the rectum are often rapidly fatal, but when there is a chance and you can operate on them the best thing is a posterior colostomy. Notwithstanding this,

many rectal wounds do fairly well if left alone, especially the posterior cases which extend from the buttock. The Trendelenberg position during operation and the Kelly-Fowler treatment are still used.

COMPLICATED WOUNDS

When the stomach, small intestine, and large intestine are wounded, the mortality is almost 100 per cent. The reasons for this are due not only to the multiplicity of organs involved but also to the length of time necessary to operate and the increased amount of hemorrhage. A combination of bladder and intestinal wounds is almost always fatal.

While at times the liver does suffer a certain amount of explosive effect, very frequently the wounds are only tunneled. In general, don't try to suture because it is very difficult to make the sutures live, but pack. Wounds of the front of the bladder are not usually so dangerous, because they can be sewed to the abdomen and usually heal nicely. With this exception, bladder cases rarely recover.

The great feature in all wounds of solid organs is the amount of hemorrhage. You must never remove a spleen or a kidney if it is possible to avoid it, and the reason for removing one should be an injury to the hylum. The tunnel wounds of the liver usually do well unless the projectile is large and the damage great. If a large fragment of projectile is embedded in the liver remove it, but if it is small leave it alone and pack the wound. Extra-peritoneal wounds are bad, worse than wounds to the thigh, because they are usually accompanied by fractures of the pelvis.

GENERAL REMARKS ON ABDOMINAL SURGERY

You usually get your abdominal cases in from 8 to 10 hours after they are wounded. The most favorable time to operate is up to 6 hours. The limit of time in which a suture can be applied to an intestine successfully is from 36 to 48 hours after the injury. If it is a question of choice between patients, leave an abdominal case with a pulse of 120 to operate on one with a lower pulse. It is always better to let a man rest a little while at least before an abdominal operation, even when there is hemorrhage. Morphine is bad for most wounded men. Abdominal cases do quite badly with it. You should never use it except to relieve pain and anxiety, and it should either be given hypodermically or under the tongue, the buccal method, which permits it to be absorbed as rapidly as by the hypodermic. The dose should be from one-third to one-quarter of a grain; one-half is too much. This dose should be expressed on the diagnosis tag, with the time and the mode of its administration. The general principles to be followed in abdominal wounds are:

1. Always operate as a matter of course, just as you would lift the bed cloths to see what is the matter with the patient, and when you do open the abdomen explore well.
2. You should push your suturing of small intestine in preference to resection.
3. In the presence of colon wounds you should open from the loin.

Drainage of the abdominal cavity is used where drainage of the intestines is doubtful, but generally this is not good practice. Drainage is always necessary in colon wounds.

Abdomino-thoracic wounds are rather frequent and they give a very high mortality. The abdominal wounds should always be attended to first, and the diaphragm had better be sutured—(1) to get prompt return of function of the organ and (2) to prevent hernia. It is interesting to note that while abdominal wounds are generally promptly fatal, the fatality in thoracic wounds occurs in from three days to a week after injury.

Superficial drains of the abdomen should not remain in for more than 24 hours. Deep drains are proper for colon wounds. Transverse colostomy in the loin is the best operation. Artificial anus may be necessary.

AMPUTATIONS

There are three considerations in amputations, in order of importance: (1) The life of the man, (2) the length of the limb, and (3) provision for a good stump.

1. *Leg*.—Provisional operation can be undertaken at the front between 4 and 6 inches below the head of the tibia. In case of shattered legs, keep away from the thigh; that is, do not go above the knee in the C. C. S.; rather do a chaff or a circular operation. This is known as the guillotine operation. If you have to amputate through the thigh keep as low as you

can because the upper third is very fatal. In flap operations the anterior flap is by far the best method, but circular amputations are best. In general, one should not pay too much attention to getting a good stump at the first operation; that can best be gotten at the base later on. The Syme's operation is the best, but it must heal by first intention or it will be a failure. If you have a spluttered thigh, don't operate through the damaged skin, but above it. Try to get a good end-bearing stump. Don't try any disarticulation of the hip joint because they all die. Do not perform lateral flap operations. When it becomes a question as to going through the knee joint, it is better to preserve the joint and go through the head of the tibia, or when you disarticulate leave the whole surface open. Indeed, in all your flap operations they should be left wide open in your primary operations at the front, where you should content yourself with ligating the large vessels and packing the cavity. Always splint an amputated leg or thigh to keep it quiet.

In operations of the upper extremity we must remember that we must save all of the limb possible; keep away from the joints. For a good articular surface for an artificial arm you should have at least half an inch of the humerus. Here, also, circular operations are the best. Always save as much as you can, especially of the thumb and little finger at least. Let the wrist and elbow joint alone and go a little above them or below them rather than to amputate at the joint. In a circular operation, which is the variety that should be done, leave everything open, and all the skin possible. In amputating at the shoulder joint leave the head of the humerus.

There are two kinds of gas gangrene. First, that which affects certain groups of muscles and ascends along these groups, leaving the other muscles in the vicinity healthy; and, second, massive gangrene.

In the first case the affected muscles should be excised, and in the second case amputation should be done at the line of demarcation, which is found by making a lateral incision until live muscle is encountered.

Amputations for damage to nutrient vessels. There is no line of demarcation in this sort of injury and we must not wait for that line, but do not hurry too much; wait at least until the parts affected by the blocking show up in a general way on the skin.

In general, for all wounds of the soft parts that can not be excised you use Carrel's method. The reason for his great success was that he employed a continuous irrigation of the great crater wound. As a matter of fact a 5 per cent salt solution is a strong antiseptic. One should never remove fragments in a compound comminuted fracture unless those fragments are absolutely loose.

In gas gangrene there are etiological factors which are important:

1. Terrain.
2. Artillery wounds or hand grenades.
3. Seat of the wound.
4. Fractures with deep penetration.
5. Presence of foreign bodies, clothing, dirt, etc.
6. Fractures of large bones and joints.
7. Vascular lesions, ligatures, and prolonged use of tourniquet.
8. Multiple wounds.
9. Hematoma.
10. Traumatic shock.
11. Presence of other germs, such as streptococcus.

The preventive treatment is:

1. Rapid evacuation; wide débridement; removal of spicules, foreign bodies, etc.
2. In localized form, with or without infiltration, curative treatment consists in completely exposing to the air the utmost depths of the wound; excision of all gangrenous or suspected tissues.

3. Amputations in cases of massive gangrene. In case of extraction of projectiles by secondary operation, we must remember that surgical intervention can invoke a recurrence of a latent infection.

VASCULAR SURGERY

Arterial suture requires the patience of Job and the guile of a serpent. As a matter of fact, the opportunity to do this vascular surgery does not come often, anyhow.

When there is a wound in the vicinity of a large vessel and there is much bleeding, clamp off the vessel and leave the clamp in place until the man gets to the C. C. S., with a note on the card to the effect that a hemostat is on. There should also be a tourniquet placed upon the man's extremity to be tightened in case bleeding comes on en route; and these cases must be watched very carefully by a reliable person. Oftentimes, on the receipt of such a man at the C. C. S., after making sure that the clamp is in place, it is better to wait a while before operating.

General Wallace once saw a man that had a small piece of shell fragment lodged inside the heart. The man lived eight hours after his wound.

The field for plastic surgery is unlimited and should be aided in every way by the concerted action of surgeons at the front and base. If we send in the limbs or crushed parts free from infection and in good physical condition, then we have every reason to expect that plastic surgery will give good results.

In the large intestine, when you get a grouping of holes you may be forced to resect but in single small holes do the purse-string suture.

Army Sanitary School No. 60.

THE CHIEF SURGEON OF AN INFANTRY DIVISION (D. I.)—FUNCTIONS, RÔLE, AND METHOD
OF A DIVISION SURGEON (M. D.)

INTRODUCTION

In response to the verbal request of Col. Bailey K. Ashford, M. C., United States Army, the chief surgeon, first class, Theoris, expounds herein the results of his war experience in regard to the functions, rôle, and method of procedure of the Army M. D. (division surgeon).

We will take for consideration the case of a D. I. (Infantry division) under the direct supervision of army headquarters without any intervening corps headquarters.

CHAPTER I

Functions of the M. D. (division surgeon) in his relations with: (a) The commander; (b) the chief and subordinate technical branches.

a. The M. D. (division surgeon) and the commander

The relations of the M. D. (division surgeon) with the division commander and the corps commanders:

I. *The M. D. (division surgeon) and the division commander.*—The M. D. gives the general technical advice and makes recommendations; he receives from the general information and orders.

(1) Technical advice: Reserve for the general technical advice related to policies. Submit all details to the chief of staff, to the first office (personnel and matériel), to the third office (operations and movements).

Matters pertaining to policies must be explained verbally to the general himself; messages delivered through intermediate agents, however great confidence one may have in the agent, lose the tone of persuasion and sometimes the accuracy of direct communication. Confirm these matters in writing. Take advantage of every opportunity to make these statements. It is thus that the M. D. (division surgeon) accomplishes what might be called a psychological preparation of the command, which is as necessary to the execution of the division sanitary service as is the Artillery preparation to the execution of an attack.

Matters of policy refer to the object, the means, and the needs of the sanitary service of the Infantry division.

(a) Object of the division sanitary service: Far from being a separate organization having different aims, the division sanitary service is, on the contrary, a vital part of the organization called a division. The object of one part does not differ from the object of the whole to obtain a maximum of efficiency with a minimum of loss.

(b) Its means: The efficacy of measures tending to preserve the strength of numbers of effectives determines the means placed at the disposal of the sanitary service.

(c) Its needs: Its needs must be considered by the commander for the same reasons and with as much importance as the needs of other branches of the service are taken into consideration. The military importance of the recovery of the sick and wounded, especially in long wars, does not permit the classification of these needs as trivial or of no importance. Experience has proved that a good organization always succeeds in distributing work and matériel so as to drive forward all the components of the organization at the same time.

(2) Recommendations: Technical advice should never be given without sufficient grounds; instead it should be based on definite facts, and practical aims always kept in view. Conclusions must be explicit and peremptory. The conclusions take the form of recommendations. Thus every report of the division surgeon includes (1) a statement setting forth all technical considerations leading up to (2) recommendations, in which the conclusions are expressed with a view to their being translated into orders, the context needing no modification by the commander. The statements may be developed in detail; recommendations should always be brief and clear. (See Exhibit No. 1 as model.)

(3) Information: Obtain from the commander all useful information, in order to secure coordination of the sanitary and tactical plans.

(4) Orders: The division surgeon receives from the commander spontaneous and solicited orders. Spontaneous orders are given without previous technical advice; they are subject to alterations and eventually to corrections when they involve technical aspects. Avoid this obstacle by persuading the commander that it is more useful in the long run to consult the technical authority first.

II. *The division surgeon and the corps commanders.*—(1) Get the information on the spot. The division surgeon must confer with the corps commander, which causes a mutual exchange of warnings and appreciations leading to a better understanding of the common work.

(2) Periodical conversations are more valuable than any kind of written demands for the overcoming of difficulties and the amending of defects.

(3) Direct observation in the company of other observers having different points of view goes to make the best understanding of the facts. Discussion at or near the place about the different interpretations offered suggests conclusions which, because they touch realities, do harmonize the discrepancies which present themselves.

b. Relations of the M. D. (division surgeon) with the chief and subordinate technical branches

I. *The division surgeon and the technical chief.*—Technically the division surgeon is dependent upon the Surgeon General. He obtains from the latter technical instruction; he directs to him regulation reports, and requests from him personnel and matériel for the sanitary service.

II. *The division surgeon and the subordinate technical branches.*—The division surgeon directs those under him to comply with the technical orders received from the Surgeon General. He obtains from them periodical and occasional regulation reports^a besides the requests for personnel and matériel. He classifies the various chiefs under his orders with regard to their promotion and honors.

The division surgeon exercises his authority in an indirect manner over the corps surgeons, who are under immediate orders of their corps commanders; and in a direct manner over the chiefs of the division formations: G. B. D. (divisional litter bearer section), S. S. automobile and ambulance (field hospitals and ambulance companies). To the former he sends his technical orders through the corps commandants; to the latter, directly. He ascertains personally the execution of these orders in the corps and in the formations.

CHAPTER II. RÔLE OF THE DIVISION SURGEON

We must consider here the part played by the M. D. (division surgeon) at the front as well as in the rear. By front-line service we mean the sanitary service extending from the first-line trenches back to the rest camps and field hospitals; by service of the rear we mean the sanitary service at the rest camps and hospitals.

^a Occasional reports must always include a statement and recommendations.

A. Service at the front

The scope of this service comprises: (1) The wounded, (2) hygiene, (3) combating gas.

I. *The wounded.*—Two points to be considered: (a) Treatment, (b) transportation. The division surgeon will take pains to have the officers and men under his command understand that transportation is a part of the treatment and just as the dressing of the wounded itself. The safety of the wounded depends largely on transportation.

(a) **Treatment:** The time and matériel required in war dressings are directly proportional to the seriousness of the damage done and the number of the "multi-wounded." Strong emphasis must be laid upon the importance of first dressings; upon the need of spacious, comfortable, and well-protected dressing stations. The antitetanic serum must be injected at the dressing stations.

The rôle of the division surgeon is of capital importance in deciding upon the site, establishing and building battalion and regimental dressing stations according to a previously worked-out scheme. If need be, he supplies the corps commanders with men and matériel not included in the regimental allowances. As the division surgeon keeps in touch with the Engineer Corps and the first office, these supplies are easy to forward. These are the best measures to bring the corps commanders to a favorable attitude. It is advisable not to undertake anything that concerns them without having their consent. An undertaking in which this principle is not adhered to might well be deemed a failure in advance.

(b) **Transportation:** (1) Regimental; (2) G. B. D. (divisional litter bearer group); (3) S. S. auto.

(1) **Regimental transportation:** It covers the ground from the spot where the man is wounded to the regimental dressing station. The division surgeon should if possible establish different "navettes" for this stage. By "navette" we mean in this case the area covered in the two-and-from movement of litter bearer details. Each "navette" uses its special means of transportation.

First. "Navette": From the point where the wounded man falls to the P. S. (battalion dressing station), first line. The use of the litter is impossible, due to the character of the terrain; shell holes, narrow winding trenches, etc. (Transportation by hand, canvas, or hammock.)

Second. "Navette": From the first-line battalion dressing station to the relay or second-line battalion dressing station. (Litter carried by hand.)

Third. "Navette": From the second-line battalion dressing station to the regimental dressing station. (Litters carried on small carts.^b) (See Exhibit No. 3.)

(2) **G. B. D. transportation (divisional litter-bearer group):** From the regimental dressing station to the central dressing station of the G. B. D., the regimental dressing stations communicate with the central dressing stations of the G. B. D. by means of communicating trenches of galleries maintained by the G. B. D.

Evacuation trenches: Special evacuating trenches for the sanitary service should be secured to be used exclusively for that purpose in quiet times as well as under fire. The method of securing and maintaining these special passages for the medical service consists in: First, requesting the transfer of only those communicating trenches considered improper or useless for military relief purposes; second, to place them and keep them in perfect condition, employing Medical Department workmen (G. B. D.); third, to put up visible posts and signs serving both as property titles and to indicate the presence and operation of the divisional sanitary service. Evacuation trenches must lead to the central dressing station of the G. B. D.

The central dressing station, G. B. D., should be built on the same plan as the regimental dressing station but on a larger scale. Its capacity for an Infantry division should be at least 30 beds and room for 50 patients sitting. The dugouts must be easily accessible to litters, both entrance and exit. Always be careful to build annex dugouts for the Medical Department men.^c Dressing stations should not be used as quarters for the men. The

^b The carts have the same width as the litters, rubber wheels, and ball bearings.

^c This is hard to carry out; Medical Department men are prone to occupy all available empty quarters, used solely in case of attack.

central dressing station of the divisional litter bearers must be a resting as well as emergency treatment place.

Comfort or resting place: Kitchen, cooking of heavy or liquid diets; considerable importance is attached to the feeding of transient wounded.

Treatment: Antitetanic injections, in case they have not been administered before at the battalion or regimental dressing stations; emergency readjustment of dressings; treatment on the spot of nontransportable wounded.

In order to take better care of the category of wounded just mentioned, the creation of an advance surgical post adjoining the central dressing station is very commendable.

Chief surgeon of the G. B. D.: In a critical situation the G. B. D. chief surgeon becomes automatically chief surgeon of the battle; in this capacity he receives orders from the division surgeon and gives orders directly to all regimental surgeons. This is the only way to distribute reinforcements, to answer requests for help, and to coordinate the different parts of the evacuation service from the first lines to the central dressing station of the G. B. D.

The central dressing station of the G. B. D. must be accessible to the automobile ambulances. In cases of urgent necessity the divisional litter bearers (G. B. D.) must be reinforced by the G. B. D. of the rear line division of Infantry. If need be the employment of prisoners of war to help the bearers is advisable.

(3) Transportation by Medical Department ambulances: Installation of a good telephone system to facilitate calls for ambulances at the rate they are needed is necessary. Calls for ambulances must be directed to the division surgeon. They should always be made according to a set and permanent form. (See Exhibit No. 4.) Care must be taken to keep departing and transient wounded always warm. The wounded must be taken directly to the "ambulance" or hospital where surgical work is to be performed. It is desirable that the medical unit to which the wounded are to be driven should be designated by the central dressing station of the divisional litter bearers (G. B. D.), according to the distribution tags made out at the battalion dressing station through which all wounded pass and are examined.

Every wounded man must go through the central dressing station, where lists of names are drawn up. (See Exhibit No. 5.) These lists bear the wounded man's name, the time he was wounded, time of arrival at the G. B. D. They enable the division surgeon to calculate the average time, to draw its graphic curve, and therefrom to reduce the average time by systematic and successive corrections of delays.^d

In the case of an attack and ensuing congestion of transportation means and lines, it is a good plan to establish an automobile relay between the central dressing station (G. B. D.) and the ambulances. The relay station should consist of tents with a capacity for no less than two to three hundred seated men. Walking wounded will be directed to this point. The seated patients will be reached and assisted by special transportation details until they arrive at the medical units designated beforehand. This is the best way to prevent confusion and preserve discipline.^e

The division ambulances are apt to be at times greatly overworked, with resulting confusion in the effort to transport numbers of slightly wounded, which must be rushed through as quickly as possible in order to accomplish their return to the trenches and preserve the maximum number of effectives. It is, therefore, advantageous to transport them in trucks, and they can then be properly distributed in any desired numbers.

The lieutenant in command of the auto S. S. (automobile ambulances) remains with the auto relay during the attack; he is relieved by the second in command, and keeps in constant telephonic communication with the G. B. D. (divisional litter-bearer group), the ambulances, and the division surgeon. He functions as a regulator. The auto S. S. of the Infantry division in action must be reinforced by the auto S. S. of the rear-line Infantry division and by the T. P. It is imperative to conserve time in transportation and space

^d The main factors of delay are: Time employed in "Navette" No. 1, depending upon the character of the terrain; number of transfers; loss of time while ambulances wait before being dismissed.

^e A simple and quite effective method of preserving order among the slightly wounded during an attack is to compel every man to sit down and to prohibit loud talking.

in the ambulances. Also Medical Department cars and ambulances should not run during the periods when rations are being brought up. In so doing they are exposed to enemy artillery fire and suffer endless delays. To wait until the line is open again saves time and trouble. This moment coincides almost always with that when the wounded begin to arrive at the central dressing station (G. B. D.).

The division surgeon keeps his eye on the movement of the different parts of the evacuation machinery; i. e., regimental dressing station, central dressing station (G. B. D.), auto relay, arrival at medical units. His place is not at the general's post, but wherever his presence is needed to better the condition of the wounded.

II. *Hygiene*.—Preach by setting the example. Medical Department evacuating trenches should be models of sanitation, construction, care of shelters, latrines, etc. Disinfection service should be carried on by details of division and regimental litter bearers, four men to each "subquarter." Cleanliness of shelters. Chemical analysis of water made by the chief pharmacist of the toxicological laboratory; bacteriological analysis made by Army laboratory.

III. *Combatting gas*.—Individual protection: Mask inspection; experience in the gas chamber; marching practice with the mask. The division surgeon and personnel of the Medical Department serve as experts in everything concerning this subject. The toxicological laboratory of the G. B. D. (division litter bearers) is charged by the division surgeon with the distribution of apparatus for individual protection.

Collective protection: Fitting up the entrance and exit of the dressing stations with a system of two articulated panels hermetically adjusted to the joists of the large galleries, leaving between this double door a space equal to one and one-half the litter length. (See Exhibit No. 6.) The "Vermorel" and the hyposulphite reservoir must be placed in a small wall closet in this room. Similar apparatus may be obtained for the company dugouts. (Against attacks of blistering gas see Exhibit No. 7.)

Treatment of gassed cases: Regimental surgeons should not hesitate to resort to bleeding in extreme cases of suffocation by gas. These cases must be given the right of way in evacuation. Prompt washing and change of clothing for men suffering from blistering vapor attacks and evacuation of these men. The chief pharmacist, toxicological laboratory, is the technical agent of the division surgeon for everything concerning gas. The distribution of the collective defense matériel is in charge of the engineers.

B. Service of the rear

1. *The wounded*.—Ordinary ambulance service, concerning which the division surgeon has only general directions to give after having assured himself of the technical guarantees offered by the surgeons.

2. *Patients*.—Establishment of cantonment infirmaries for men not seriously sick and the crippled. Detail one of the division field hospitals to attend men more seriously sick and crippled but who may be returned to duty after 10 or 15 days. The division surgeon should frequently investigate the disposition made of the men he has evacuated. This field hospital constitutes in calm periods what might be called a filter, preventing the melting of the numerical strength. Select a very energetic commanding officer.

3. *Dental patients*.—The division surgeon should take particular care in looking after the installation of comfortable and efficient dental offices. Dentists render inestimable services, especially to officers who want to be treated at the front. Dental work is of such a character that it can only be performed in rest camps. Each rest camp should count upon one dental office with two operators.

4. *Hygiene*.—Camps and cantonments: Inspection of water, shower baths, latrines and quarters; use of efficient personal hygiene sections.

CHAPTER III. METHOD OF PROCEDURE OF THE DIVISION SURGEON

It is entirely a method of observation and execution. Success in execution never depends upon the number of detailed rules and regulations, but upon the personality and acuteness of the executive. The division surgeon should keep clearly before him the end in view and refrain from becoming involved in details. (See Exhibit No. 10.) Execution depends chiefly upon the man who executes and the division surgeon should be given full

power in choosing his men for their tasks. His is the task of psychological preparation of his men. Neither threats nor praise, but persuasion and enthusiasm, should stimulate the surgeon in his work. The method of the division surgeon is twofold, and the two aspects, though essentially different, are complementary to each other. The work is also twofold: Administration, on the one hand, and organization, on the other.

Administrative work.—It is essentially automatic work, to be entrusted to automatons, men capable of repeating well the same processes time and time again. The division surgeon should not touch administrative work with the excuse of improving the same, in spite of the importance attached to it in higher spheres. He will never become the equal of an automaton unless he is an automaton himself. (See Exhibit No. 8 concerning automatic work in the office of the division surgeon.) This does not mean that he should avoid intervention altogether. His intervention must be felt, for instance, when regulations clash with common sense; e. g., when the care of the wounded would seem to be sacrificed for the benefit of regulations. Regulations should be framed so as to permit any broad-minded man to justify measures taken by him in accord with common sense. Thereby the division surgeon can wisely help to correct the mechanical exaggerations of automatism.

Organization work.—Administration is the preestablished form to which is affixed the life of a given service, permitting to foresee, to purvey, and to control. This form provides great security to the development of foreseen, easy problems; it affords all sorts of contrivances to help solve unexpected and more difficult problems. Automatism is acceptable only when it makes possible the proper execution of acts repeating themselves identically and whose sole value comes from this very repetition of identities. There results for the division surgeon an economy of effort, allowing him more time for the solution of problems whose nature defies automatism. War calls forth entirely new unexpected questions to which ready made answers can not be given without risk of confusion and failure. Administration is a static form; intervention is a dynamic function, and its apparent form is called organization.

Organization is the coordination of means invented to resolve problems brought forth by reality as the incessant changes of war go on. Permanently adapted acts may be added as automatic functions, provided their adequate repetition proves to be expedient. They may be registered and regulated by the administration without, however, allowing them to interfere with invented measures, which are the privilege of the organizing genius in his endeavors to coordinate and adapt.

CONCLUSIONS

A biological example may help us to understand thoroughly the functions, rôle, and method of the division surgeon. The Medical Department presents, on the one side, periphery cells with activity of their own; such are the regimental surgeons and commanding officers of field hospitals and ambulance companies. They should possess the following qualities: Impressibility to facts, as one body attracts another; in short, they should be intensely familiar with the external world. It is not to be expected that everybody will show these qualities, but it should be the division surgeon's task to revive them when they threaten to perish. Surgeons can not be easily convinced; they take with great cautions all new suggestions. Innovations can not be forced upon them. In order to persuade them, rap at the door of their intellect, rap chiefly at the door of their heart. It will never be done in vain.

The periphery cells receive external excitation. Transmission, to that effect, must be rapid and direct. The suppression of all unnecessary intermediaries becomes imperative. The division surgeon, acting as central brain cells will revive thereby an undiminished excitation. Far from becoming detrimental to the periphery cells through a monopoly of all initiatives, this gray matter must be a kind of distributing agent of accumulated energies conducive to the maintenance of high individual will standards. Do not try to impose, but rather leave everyone to their own initiative, provided they tend to a common end. The organization of the division Medical Department service, wherein meet the functions, rôle, and method of procedure of the division surgeon, has everything to gain by the encouragement of a free original personality.

[SEAL]

(Signed) Dr. A. THOORIS,
74th Infantry Division, Medical Service,
Division Surgeon.

EXHIBIT No. 1

74th Division S. S. No. 6972.

REPORT BY CHIEF SURGEON, FIRST CLASS, THOORIS, ON MODIFICATIONS TO BE MADE IN THE EVACUATION OF THE MARGUERITE ZONE

DECEMBER 31, 1917.

The G. B. D. (divisional litter-bearer group) at the Moseow Brewery affords a very good shelter, spacious enough for 30 recumbent patients; owing, however, to the establishment at the sugar mill of a regimental dressing station, it was left outside the evacuating zone, and is therefore useless. A new study of the evacuation régime in this zone was made by the division surgeon and the chief surgeon of the divisional litter-bearer station (G. B. D.) after conferring with the colonel commanding the zone. There are reasons for abandoning the Moseow dressing station and attaching the wheeled-litter-relay, located at the junction of Moscow and Mitau communicating trenches, to the G. B. D. The fitting up of the common trench Mitau, ordered through note No. 4535, Q. G./74, dated December 29, 1917, just answers the new disposition recommended. It is understood that the evacuation of the Falaise quarter will be made directly through La Chapelle.

RECOMMENDATIONS

That the G. B. D. dressing station be transferred from Moseow to the wheeled litter relay, where Mitau meets Moseow trench.

Madelon Quarter.—That the evacuation be assured by battalion litter bearers from the point where wounded fall to the wheeled-litter relay.

The G. B. D. from this relay to La Chapelle.

Falaise Quarter.—Evacuation be taken care of by litter bearers belonging to the ehas-seurs company occupying the Marine Woods, extending from the point where wounded fall to La Chapelle.

Telephones be installed in La Chapelle.

Detailed orders will be issued by the division surgeon in regard to the G. B. D.

(Signed) A. THOORIS.

Recommendations approved.

The commanding general of the division.

(Signed)

DE LARDEMELLE.

EXHIBIT No. 2

REGIMENTAL DRESSING STATION

Legend:

- A. Evacuating trench.
- B. One of the two entrances to dressing station and stairs.
- C. Cabinet of the chief surgeon.
- D. Dining rooms.
- E. Lobby for visitors.
- F. Storeroom.
- G. Stairs leading from the dressing station to the waiting room.
- H. Waiting room.
- I. Second entrance to dressing station.
- J. Receiving office.
- K. Room for dressing and treatment of shell shock.
- L. Ward (12 beds).
- M. Cistern.
- N. Exit (stairs) leading to the evacuating trench.
- O. Large passage connecting the dressing station with the litter bearers' quarters. In case of congestion due to rush of slightly wounded, this gallery is used to shelter them.
- P. Quarters for litter bearers and ward masters.
- Q. Evacuating trench No. 2.
- R. Latrines.

EXHIBIT No. 3

74th Division S. S. No. 6818.

DECEMBER 22, 1917.

REPORT BY CHIEF SURGEON, FIRST CLASS, THOORIS, DIVISION SURGEON /74, ON THE SUBJECT
OF EVACUATION FROM THE FIRST LINES TO REGIMENTAL DRESSING STATIONS

EXISTING ORGANIZATION

a. Previous considerations.—(1) Technical: In order to obtain good results, transportation work must not exceed the physical strength of the men. Long stages, therefore, should be avoided and short ones encouraged.

(2) Tactics: Defense is organized by zones. It is advisable to adapt evacuation movement to defense dispositions and the men to quarter and zone work. Defense dispositions allow two quarters, one of the first line and one of the second line. Each of these quarters, occupied by one battalion, disposes of one dressing station attended by the battalion surgeon and part of his men. These men belong to the battalion. The roster of forces issued July 10, 1917, does not mention company. Litter bearers, infantry. Litter bearers are attached to the "battalion N. C. O. staff," 7 to each company. Stress should be laid on this fact: That litter bearers are substantially a battalion formation. This must be so to avoid the bad habit exhibited by some companies of "embezzling" all available litter bearers. This deprives the battalion surgeon of all his litter-bearer reserves, warps ipso facto the mechanism of evacuation, and furthermore charges the regimental medical service with duties it has no means of performing.

b. Transportation problems in a sector.—(1) Distribution of men: Litter bearers placed at the disposal of the surgeons of the various units are not sent without precise directions as to their employment.

(a) First-line quarter: The battalion disposes, in theory, of 25 litter bearers and 1 litter-bearer corporal, but he must count on 20 only on account of sickness, leaves, etc. He will attach to each Infantry company 4 litter bearers; that is, 12 to a battalion. Machine-gun companies, usually being divided into sections and these attached to different units, will avail themselves of the litter bearers of such units. Thus 8 litter bearers are left to the battalion dressing station under orders of the litter-bearer corporal.

(b) Second-line quarter: The reserve detail of 8 litter bearers can be reduced to 4, the other 4 being transferred to the zone chief surgeon as a zone reserve.

(c) Zone dressing station: The zone dressing station disposes of a litter-bearer reserve, 4 to each second-line battalion, under the command of a litter-bearer sergeant. If the dressing station attends two zones, it will have a reserve of 8 men.

(2) Transportation: Litter bearers must pick up and carry all wounded fallen in their zone, no matter what their arm or corps. Transportation is carried out by walking posts (navettes).

First post from the point where the wounded fall to the first-line quarter dressing station, in charge of company section.

Second post from first-line quarter dressing station to the zone dressing station, in charge of a battalion reserve section. If the distance is considerable, the zone chief surgeon creates an intermediate relay. In this case:

Third post from the relay to the zone dressing station, in charge of the zone dressing station reserve section. The second-line quarter dressing station can be used generally as relay station.

RECOMMENDATIONS

Experience gives us a few rules with regard to regimental evacuation in a sector.

1. *Post ("navette") method.*—A maximum of efficiency and speed should be demanded of regimental litter-bearer sections, though care should be taken to avoid excessive fatigue, the consequences of which the wounded man himself would be the first to suffer. The methodical operation of the post system accomplishes these ends. The post system consists in dividing the ground into sections, each section or post being covered back and forth by the same detail of men. Posts are limited by the dressing stations. First post from the first-

line trench to the battalion dressing station or first-line quarter. Second post from the battalion dressing station or first-line quarter to the regimental or zone dressing station. Third post under operation only when the distance between the first-line quarter dressing station and the zone dressing station is too long; a relay post is established. Sometimes the second-line quarter dressing station takes charge of it.

2. *Operation of posts.*—(1) Distribution of men in units and dressing stations: The regularity of posts brings forth a convenient distribution of regimental litter bearers. To this end the corps commanders will observe from now on the following instructions:

Each company in line shall have 4 litter bearers, except the machine-gun company, whose sections shall avail themselves of the services of the litter bearers of the companies to which they have been attached.

The first-quarter dressing station shall have 1 corporal and 8 litter bearers; the second-line quarter dressing station, 1 corporal and 4 litter bearers.

The zone dressing station shall have 1 sergeant and 4 litter bearers to each zone obtained from the battalion stationed in the second-line quarter.

(2) Men working on posts: First post, company litter-bearer section; second post, quarter dressing station reserve section; third post, zone dressing station reserve section.

(3) Coordination of posts: Only unity of direction can secure a coordination of posts. This direction is entrusted to the chief surgeon of the zone; he designates the details and regulates the automatic movement of the various posts. The squad sergeant executes the orders issued. The details of men under orders of the zone chief surgeon, without interfering with the distribution principles as prescribed by the post system, form a sort of platoon for sanitary maneuvers, held in readiness for service in its zone, or in the zones served by the zone dressing station, as the case may be. When because of an increase in the number of wounded, and despite the reciprocal aid between zones, the regimental sections fall short of their work, the chief surgeon of the zone requests a reinforcement from the division surgeon, through the division commander. In no case shall the services of the G. B. D. (divisional litter-bearer group) be utilized outside its own zone of action.

It is understood that the use of reinforcements, G. B. D. (corps litter bearers), or territorials, must be subject to the same adaptation to post duties. The same process should be repeated many times until absolute mastery is acquired. All litter bearers should have technical as well as psychological training for special quarter and zone duty. They should also be taught to lift and carry all wounded, irrespective of arm or corps. The division surgeon maintains wounded from the collapsing point to the hospitals.

EXHIBIT No. 4

(G. B. D. to M. D.)

From: Divisional litter bearers to division surgeon.

To: Requesting ambulances for recumbent patients and sitting patients.

N. B.—Requests giving the number of cars and not the number of wounded shall be refused. In time of danger requests for cars are usually overestimated, which results in some cars returning empty.

EXHIBIT No. 5

Station	Remarks
Automobile transportation. Day..... 1918. (0 to 24 hours.) 74th Division G. B. D./74.	1. Date and time of wound..... 2. Name in full..... 3. Regiment, company, or battalion..... 4. Nature of wound..... 5. Place of wound..... 6. Time of arrival at first station G. B. D..... 7. Time of loading the wounded..... 8. Place of loading..... 9. Total time between 6 and 7..... 10. Seated recumbent..... 11. Remarks.....

EXHIBIT No. 6

METHOD OF WORKING PANEL IN TIME OF DANGER

Shut both panels (doors); between them there shall stand constantly one litter bearer or other Medical Department man provided with a "Tissot" and with instructions to sprinkle a solution of hyposulphite in the intermediate space and over the panels.

Whenever a wounded man is to be taken in, open first panel, order the wounded and men in charge to step inside, and sprinkle again the space and the panels. Open second panel, order the detail into the dressing station, shut the second panel and operate again the "Vermorel" in the intermediate space.

EXHIBIT No. 7

74th Division staff. First Office No. 850/B.

Recent bombardments where gas shells have been used called for a rapid survey of the places shelled in order to ascertain the nature of the gas employed by the enemy and to take all necessary protective measures. Battalion sanitary squads are to be in charge of this work under the orders of unit pharmacists, who serve as gas experts.

Experts and sanitary squads will be distributed as follows:

Zone A: The regimental pharmacist and the sanitary detachment of the battalion occupying the bombarded quarter.

Zone B: The regimental pharmacist and the sanitary detachment of the battalion occupying the bombarded quarter.

Zone C: The pharmacist of the G. B. D. (divisional litter bearers) and the sanitary detachment of this formation.

Zone D: The pharmacist and the sanitary detachment of the B. C. P. (litter bearers of the central post) occupying the bombarded quarter.

The terrain occupied by batteries, when shelled with gas shells, will be surveyed by an expert pharmacist under conditions specified in note No. 850/B of 74th Division, dated December 27, 1917.

1. East of the road and north of the river: Pharmacists designated for zones A, B, and C.
2. West of the road and north of the river: One pharmacist of G. B. D. (divisional litter bearers).
3. South of the river:
 - (a) Geais Wood and Oasis Battery, the B. C. P. pharmacist of the eastern quarter.
 - (b) G. ——— Wood, pharmacist of the B. C. P. at rest.

Sanitary squads will be furnished by the batteries situated in places found to have been bombarded with gas shells.

Battery commanders will apply to the zone headquarters, to the G. B. D., or to the commander of the B. C. P. at rest, as the case may be.

EXHIBIT No. 8

OFFICE OF THE DIVISION SURGEON

I corporal.

1. Care and sorting of the mail.
2. Paper work and daily reports:
 - Situation report No. 2.
 - Situation report every 5 days.
 - Situation report every 10 days, etc.
3. Accounting:
 - Cash register.
 - Making out checks and transfer of deposit orders.
 - Quarterly accounts returns.
4. Classification of all documents, circulars, papers, and pamphlets.
5. Personnel report.

1 secretary.

Typewriting, maps, multigraph.

Telephones.

1 cyclist.

Recorder of mail (incoming and outgoing).

Liaison with the army and the division commander.

Checking up of the supplies and drugs requisitioned from the chief pharmacist of the laboratory of toxicology.

FILING OF DOCUMENTS AND CIRCULARS

All papers are classified and distributed in files with alphabetical references.

Experience has shown the convenience of distributing papers under the following main headings:

1. Personnel—
 - Officers.
 - Enlisted men.
 - Discipline.
 - Leaves of absence.
 - General subjects.
2. Subsistence—
 - Food.
 - Heating and lighting.
 - Clothing.
3. Pay and allowances.
4. Matériel—
 - Pharmacy and toxicology.
 - Gas masks and gas supplies.
 - Matériel for sanitary organizations.
5. Evacuations.
6. Treatment of sick and wounded—
 - Contagious diseases.
 - Venereal diseases.
 - Serums and vaccinations.
 - Poisoned men.
7. General hygiene and disinfection.
8. Reports from division surgeon.
9. Daily report on marches and operations.
10. Pay rolls.
11. Periodical orders.
12. Sector file (position and attack).

EXHIBIT No. 10

Without organization there is no good execution. Building up organization depends upon repeating the same things again and again, but it differs from plain routine work in the variation of means according to circumstances. Orders should specify the essential motive to be repeated, but they should leave a liberal margin for the choice of means for the execution of the details. In this way every man knows what he has to accomplish and at the same time he enjoys a certain liberty of action within the limits of his task. For example, orders should designate the starting and ending points of posts ("navettes"), but not the route to be followed, which varies according to the course of the battle; litter bearers will use their own judgment; the shortest road for them may be the straight line, the trench, the trail, or the road. They must be allowed to decide for themselves. The only restriction placed upon them is that they start from a set point and reach another within reasonable limits of time.

Organization is most necessary in the execution of orders while the battle is actually in progress and the inevitable disorder resulting. The argument sometimes presented by

the G. B. D., that it fails to keep the lists of names of transient wounded because of the rush of patients, should be rejected. The careful keeping of list of names in case of danger is an excellent contrivance to regulate the movement, to make the wounded understand that they can not escape being registered, and that any attempted deceit will come to light at one of the units in the rear. When a G. B. D. chief surgeon states that he is overwhelmed and becomes unable to behave in a crisis as he would in ordinary times, there is no clearer sign of his military incapacity. He should be transferred to a position more suited to his temperament. It is surprising to find how many unfit for a given sort of work will prove to be very efficient elsewhere. It is in appointments of this kind that the judgment of the division surgeon are put to the test.

Army Sanitary School No. 62.

WAR WOUND BACTERIOLOGY

SUMMARY OF A LECTURE BY M. LE MEDECIN-MAJOR TISSIER, OF THE PASTEUR INSTITUTE

Historical data.—Bacteriology of war wounds tracing back its origin to the beginning of actual war:

(a) Doyen and Yamanouchi, Weinberg, Sartory and Spillman, Reverchon and Vaucher, Levy-Fourcade and Bollach find *B. perfringens* in war wounds.

(b) Weinberg moreover finds *B. sporogenes* and *B. putrificus*. Sacquepee describes two distinct infectious processes: The one due to the common septic vibron, the other to a new bacteria, *B. bellonensis*. Weinberg and Seguin describe the oedematiens and three distinct infections: A gangrenous form due to *B. perfringens*, a putrid form to *B. sporogenes*, and a toxic form due to *B. oedematiens*.

(c) The work of Carrel on the sterilization of wounds assigns paramount importance to the number of microbes.

(d) Recent researches recall attention to the specific action of infectious organisms

A study of the microbes found in wounds in war.—Classification is derived from chemical properties.

(a) Simple ferments possessing only one dominating diastase which can act on albumen compounds. They may be divided into simple proteolytic and simple peptolytic ferments from their respective modes of action on the molecule.

(b) Compound ferments, two equally powerful diastases, the one acting on albumin compounds, the other on the hydrated carbon compounds. They are divided into compound proteolytic and compound peptolytic ferments.

Morphological features—

Aerobic:

(1) Compound ferments in war wounds—

M. candidus, nonliquefying.

M. flavus, liquefaciens.

staphylococcus.

B. cutis communis.

Diplococcus grisens, nonliquefaciens.

enterococcus.

streptococcus—

(a) true streptococcus; broth does not get turbid; hemolysis.

(b) Saliva streptococcus; broth turbid; no hemolysis.

(c) *Streptococcus tenuis*; very slender chains.

Pneumobacillus.

Proteus vulgaris.

Green fluorescing B.

(2) Simple ferments—

B. mesentericus and *B. Mucoides*.

B. pyocyaneus (4 varieties—yellow, blue, red, black).

Morphological features—Continued.

Anaerobis:

(1) Compound ferments—

*B. perfringens.**B. bifementans.**B. of Baval*, nonliquefaction—

(2) Simple ferments—

*B. putrificus.**Septic vibron.**B. of tetanus.*

Chemical properties.—These microbes are found crowded together and associated in putrefying matter. Study of common putrefaction.

(a) Period of action of anaerobic compound ferments: *Perfringens*, *bifementans*.

(b) Period of action of simple ferments: *Putrificus* and *Septic vibron*. Destruction of the albuminoid molecule.

The part played by aerobic microbes is secondary: In principle, they take oxygen from the tissues; in the end they decompose the amine compounds.

Microbe germs can exert a predominating influence only when local circumstances have become favorable.

Study of aerobic putrefaction. The *proteus* and the *pyocyaneus* taking the place of the great anaerobes—a case of aerobic putrefaction on the skin.

Biological properties.—Two kinds of “toxine”: An adhesive toxine with a small radius of action and an invading toxine, such as that in tetanus.

(1) Aerobic microbes are in general slightly pathogenic pyogenic microbes; streptococcus, the only one of importance in our case, seems to possess an adhesive toxine, a diffusive toxine, and a special hemolysin, *mesentericus* and *proteus*, possessing a hemolytic action due to their trypsin diastase. *Pyocyaneus* pathogenic: *Pyocyanase*.

(2) Anaerobes: They do not seem to possess any diffusive toxins, except that of tetanus. Living tissue is not a favorable medium for the growing of anaerobes; it must become a “terrain” prepared by, first, either aerobic microbes, or second, by a previous mortification of such a tissue.

In war wounds these two conditions are fulfilled. The rapidity of evolution depends on the nature of the superadded aerobic. The greater the tendency of the aerobe to spread in the general circulation, the sooner will the fatal anaerobic septicemia occur.

SUMMARY OF WAR WOUND BACTERIOLOGY, PART II

The primary infection of war wounds may be due to two kinds of causes: (1) Dust, mud, or dirt on clothing and skin; (2) feces and saliva. There exist carriers of putrid germs and also carriers of streptococci.

Two kinds of septic accidents in war wounds: (1) Putrid accidents; (2) purulent accidents.

Putrid accidents characterized by two chief features: Localized forms and diffusive, invading forms.

In localized forms, a variety of aerobes are found: *Candidus*, *griseus*, *enterococcus*, *mesentericus*, some anaerobic, *B. perfringens* always, *B. bifementans* occasionally, and *B. de Baval* as an exception in severe cases.

Afterwards the *Septic vibron* and *B. putrificus* are also found.

Every microbe has its own special cycle of evolution.

Anaerobic infection passes through a maximum on the third day, and disappears between the seventh and tenth days, but persists in badly cleaned wounds; generally it will terminate when swarms of phagocytes will have crept in.

A gaseous abscess indicates failure of the gangrenous and putrid process.

Arrival of secondary pathogens: Pyogenic.

Diffusive forms: Same anaerobic flora with same virulence as above; but aerobic flora is different.

In the slow diffusive form, besides the above mentioned species, staphylococcus or *pneumobacillus*, both pyogenies, are also found.

Stages of the invading process: "oil-stainlike" at first; then lymphangitis with staphylococcus, and finally lymphangitis with anaerobic microbes and hemolysis.

In the rapid forms, streptococcus is always found.

Out of 100 severe cases, I had as an average 39 putrid wounds (anaerobic); in 20 cases, associated with saprophytes only; in 10 cases, associated with staphylococcus; in 9 cases, with streptococcus.

Late putrid infections consist in partnerships of anaerobes and streptococci. Immunity exists up to a certain degree, and lessens danger.

Purulent accidents: Three categories: mucopurulent wounds, purulent wounds, febrile purulent wounds.

Mucopurulent wounds: Contain *enterococcus*, *candidus sarcine*, *mesentericus*; if left open, get infected with *proteus* and *pyocyaneus*.

Purulent wounds: Contain staphylococcus—progressive appearance of secondary pathogens; *Staphylococcus aureus*, *B. cutis communis*, *Proteus vulgaris*, *pyocyaneus*. Special action of the *pyocyaneus* finally predominates.

Febrile wounds: Contain streptococcus, special local reactions; liquid pus very abundant; paring of tissues; general reactions marked—fever, pale complexion, depression, loss of spirit.

Arrival of secondary pathogens; streptococcus does not disappear, is only concealed by overgrowth of the *pyocyaneus*. It can grow well in the blood, the bone tissues, and the articular tissues. Any articulation it has invaded may be considered as irretrievably lost; any bone it has touched will for months and years carry traces of streptococcus infection.

A wound in soft parts, with streptococcus, may occasion fever for 6 or 12 days only; a wound in bones, for 21 days; a wound in articulations, for several periods of 21 days.

So great is the affinity of streptococcus for bone tissue that I never met with any bone fistula, due to a war wound, where streptococcus would be absent.

Streptococcus is the most active, the most tenacious, the most dangerous aerobic species; its presence alone suffices to render surgical intervention of no avail. Secondary streptococcus infection should be avoided at all costs. Isolation for wounded who are germ carriers.

In war wounds, there occurs putrefaction: (1) Common anaerobic putrefaction in recent wounds; (2) aerobic putrefaction "en nappe" in old wounds.

Sudden and rapid poisoning in the former case; slow poisoning, cachexia, in the latter.

Summary: (1) Every wound has its special cycle of evolution depending on the microbial species which causes the infection. (2) Microbial infection is made easier by presence of mortified or bloodless tissue. (3) Any wound, if left opened, will be subject to new microbial invasion.

This shows the absolute necessity of rapid and complete surgical excision, and of suturing at earliest moment; except when streptococcus is present.

Any wound where streptococcus is absent, ought to be primarily closed, and will heal if excision was complete.

Results, Auto-chir 12: Before practice of excision 57 per cent of gaseous gangrene cases proved fatal. After excision, percentage has fallen to 22 per cent. Out of 21 very severe cases, sutured at first, then reopened on account of anaerobes and streptococcus, 3 only proved fatal. Out of 63 putrid wounds without streptococcus, 1 fatal case only (vascular lesion).

Out of 759 sutured cases, 722 cured, 37 voluntarily reopened on account of streptococcus.

Percentage of successes, 88 per cent (including 109 cases with fractures).

If wound was not sutured originally, apply secondary suture as soon as possible.

If saprophytes only in wound, cure certain.

If staphylococcus only in wound, wait from 6 to 10 days.

If streptococcus in wound, wait for 21 days at least before attempting intervention; cure dubious; failure, when it is a case of bone lesion or articular lesion.

WAR WOUND BACTERIOLOGY

By Medecin-Major Tissier

Let us pass rapidly over the phenomena attendant upon the wounds of war. It is a subject of great importance. A war wound is one where the tissues are broken up or carried away by a projectile. Complex phenomena of fermentation take place, upon which depend the future of the case. How can the surgeon foresee the result if he is not cognizant of this phenomena, if he not even able to predict the type of fermentation, upon which may depend not only the functional repair of the affected member but also the life of the patient. Let me warn you that the bacteriology of war wounds dates from this war. The immortal work of Pasteur has made us familiar with ordinary bacterial suppuration. We also know from him one of the particular organisms concerned in the production of gas gangrene. Recent work has shown another species, the *Bacillus perfringens*, even in malignant forms of edema, in various sorts of gangrene, and certain incidental fermentation. We also know from the researches of the Pasteur school the nature and evolution of the germs of putrefaction; but we did not know of the surgery of gas gangrene, diffuse phlegmon, or gas abscess. Suppuration was rare. We knew nothing of surgical intervention. There had to be terrible mistakes made at the beginning of the war to attract our attention to the bacteriology of war wounds. It must be admitted that the great wars of past times have given us no precise information. Neither the Manchurian nor the Balkan wars serve us as a light upon this subject. You all know the information we had at the beginning of this war. First, sterilization of the skin by tincture of iodine; second, packing the wound; third, function. The rôle of our field hospitals was to pack or dress wounds. We all remember the disasters that followed. Those who lived through the Battle of the Marne and the Yser have preserved an awful memory of this time.

Among those who stayed behind in their laboratories, some workers interested themselves in the task of studying and, if possible, of avoiding the dangerous complications which carried off so many wounded. In November, 1914, Doyen and Yamanouchi, and then Weinberg, made a report to the society of biology that in gas gangrene they found *Bacillus perfringens* and various pyogenic cocci-staphylococci, streptococci, etc. Fleming, Sartory, and Spillman, Reverchon and Vaucher, later Levy-Fourcade and Bollach, confirmed the specificity of *Bacillus perfringens*. However, they all brought out the fact that they found this organism more or less mixed with cocci and called attention to the devitalizing of tissues as a factor in the genesis of gas gangrene. The surgeons who closely studied the clinical phenomena were concerned with the multiple forms of these. They found gas forms, gangrenous forms, and massive forms. Raval described seven distinct forms. Bacteriologists tried to find the cause of these distinct evolutions. Weinberg reported *Bacillus sporogenes*, *Bacillus putrificus* and *Septic vibrio* in certain rare forms. Sacquepee described the variety of *perfringens* which he thought was the specific bacillus of malignant edema. Costa and Iroisier also described a new germ, *Bacillus lyticus*. They thought that ordinary gas gangrene was due to an association of pneumococcus and *Bacillus perfringens*. There gradually arose some doubt as to the specificity of *Bacillus perfringens*. It was found in almost all war wounds. Noll, Fisbinger, and Renemontac found a *Bacillus perfringens* in 80 per cent of their cases and the septic vibrio in only 20 per cent. The aerobic organisms played a lesser rôle. They were found in only 50 per cent of the wounds. In opposition to the studies of Edna Steinhart who discovered a toxin of *perfringens* which Hermath Taylor denied, stating that no endo-toxin or exotoxin existed, Sacquepee believed that the ordinary form of gas gangrene was due to the septic vibrio of the massive form, the white edema due to a new species of *Bacillus bellonensis*. Weinberg and Seguin also found different new germs, *Bacillus oedematiens*, in these same forms. Quite recently these two authors tried to find a different organism for each of the two clinical varieties. They divide gangrene into three classes: (1) The gangrene variety due to *Bacillus perfringens*; (2) the putrid variety due to *Bacillus sporogenes*; and (3) toxic varieties due to *Bacillus oedematiens*.

They recognize, however, the existence of mixed varieties. Then came talk of a vaccine of serum therapy. Weinberg and Seguin propose a polyvalent serum for the first hours of infection as a sort of preventive, as well as a serum directed against the dominating species—

therefore, a creative serum. Sacquepee, Marbat, and other authors made researches in the same direction. The surgeons did not seem to take much interest in these studies. They mostly went over to Carrel's method. They laid the wounds open widely depending upon progressive disinfection, the antiseptics, and the Dakin's solution. The chemical bistoury was made to complement the scalpel of the surgeon. The surgeons seemed to be busy in constructing germ cures; that is to say, that the number of microbes only was of importance. The quality of the invading germ was left more and more in obscurity. But a series of events fortunately brought the state of the quality of the germs to its true place and directed surgery into a new path.

We will now take up the microorganisms found in war wounds. They are aerobic and anaerobic. We will class each one of these two varieties in accordance with their chemical properties, which are, basically, the least changeable. We will, therefore, class them in accordance with their fermentative action into, first, those producing simple ferments; second, those producing mixed ferments. Simple ferments seem to possess but one diastase, acting upon albuminoid matter, depending upon whether the intact molecule of albumin is or is not already peptonized. These are designated under the name of simple proteolytic or simple peptolytic ferments. Mixed ferments seem to have equal diastases: One acts upon the albuminoid molecule, the other upon the carbohydrates. The latter produces acid bodies which at certain stages paralyze all diastase action. That is the acidity of arrest for each species. We will subdivide these ferments in accordance with this action upon intact or peptonized forms into, first, mixed proteolytic; second, mixed peptolytic.

Among the aerobes isolated from the wounds caused by war we find many combined ferments. These are first of all of a common variety, the microbes of the air.

Micrococcus candidus.—This has colonies of a characteristic concentric form, white in color, not capable of liquefying gelatine. We can distinguish two varieties: (1) Those which do not convert lactose, but convert all the other sugars; and (2) those which convert all sugars without exception. Their acidity of arrest is the same, namely, 1.47 per thousand, in terms of sulphuric acid. *Micrococcus flavus liquefaciens* has yellow colonies and liquefies gelatine.

One finds among the microbes of the skin or mucous membrane *Staphylococcus albus*, and very rarely *Staphylococcus aureus*, whose acidity of arrest varies between 1.47 and 1.96.

Bacillus cutis communis gives rise to small irregular colonies not discrete and shows the most varied kind of involution. This bacterium is known under many different names—pseudo-diphtheritic, eosine-baeterium, Bacillus of Seborrhea, Bacillus of Acne. It converts glucose, levulose, saccharose, but has no action upon lacto-glucose, maltose, or mannite. Furthermore, one finds three kinds of cocci, all of them forming small colonies. These are *Diplococcus griseus*, enterococcus, and streptococcus. The first is irregular in shape, even in short chains, and is capable of a slight effect upon glucose. The enterococcus, on the other hand, possesses powerful qualities. It converts all the sugars, giving an acidity of arrest of between 2 and 3. It always clouds bouillon and grows well on potato and gelatine.

The streptococcus deserves our more careful attention. There exist several varieties. The classification of streptococci has been the subject of numerous discussions during recent years. After admitting the existence of several varieties of this species, one is forced to return to the conception that there is a single one. You recall the celebrated discussions between those who admitted the existence of only one variety and those who believed in the existence of several. It is necessary to return to the ideas of Veillon, who 20 years ago described three varieties of streptococcus—*Streptococcus pyogenes*, *Streptococcus salivarius*, and *Streptococcus tenuis*. The means that we have actually had at our disposal, namely, the fermentation test and complement fixation, have only emphasized the difference between these varieties based on morphology. There is a true streptococcus in long chains which does not cloud acid bouillon. It does coagulate milk; it does not grow on potato and but poorly on gelatine; it gives an acid arrest on glucose bouillon of between 1.47 and 2 and hemolyzes blood.

Streptococcus salivarius appears in long chains, clouds bouillon, coagulates milk, grows on potato in certain cases, gives an acid arrest of between 2 and 3, and is not hemolytic.

Streptococcus tenuis is much less common and very little is known of it. Complement fixation emphasized the difference between the two species described, as well as did morphology and its clinical manifestations.

In addition to the aerobes possessing combined fermentative qualities found in wounds of war, we should mention three microbes occurring with varied frequency. All three ferments produce acids but very slowly and give a marked production of ammonia. Properly speaking they should be described as aminolytics. They exert a more marked action than those of peptone. They are *pneumobacillus*, *Bacillus proteus vulgaris*, and *Bacillus fluorescens*. These three species are not met with in the same frequency on all fronts. On the Flanders front in 1915 I did not meet with the *pneumobacillus*. I found several samples in 1916, but not often. On the other hand, on the Aisne, this bacterium appeared to me to be the most frequent especially in rainy weather. The Belgian bacteriologists told me that they have at times run across the *Bacillus coli communis*, but that has not been my experience. The aerobes that one finds in wounds of war are two classes—*Bacillus mesentericus* and *Bacillus pyocyaneus*. The first is very frequently encountered in recent wounds of the war; it grows easily in dead or contused tissue.

The most common variety that has come to our notice has been the *proteus*, which has a slow action upon glucose, maltose, and levulose. Le Gros in 1902 described among the gangrene-forming bacteria one very similar to this, if not the very same one, which he spoke of as *Septicus aerobius*.

Bacillus pyocyaneus is a well-known species. It has powerful fermentative qualities.

Now we come to a consideration of anaerobes. We have isolated the *Bacillus perfringens* as having fermentative properties. It is a large immobile bacillus, with square ends, and appears to be capsulated. It liquefies gelatine, destroying rapidly albuminoid material and sugars. It possesses three diastatic properties similar to that of the pancreas, all of which are very powerful. This very common bacteria was first seen and described by Welch, and more completely described by Veillon and his students, and finally studied from the surgical point of view by Tissier and Martelly. It gives rise to large oblong spores. In conjunction with this bacterium, of which one finds many varieties in the wounds of war, should be mentioned a similar bacterium, *Bacillus bifermentans*. It is immobile, destroys albuminoid materials, gives gas and traces of indol, but has no action on lactose. It was described by Tissier and Martelly. It produces small, round spores.

The *Bacillus putrificus*, isolated by Bienstock in 1899, was studied from a chemical standpoint by Sehaline and by Martelly in 1902. It is a well-known species. It has a round ball for a terminal spore. The *Bacillus Barat* is very mobile and is, in my opinion, a variant from the *Vibrio septique*, from which it does not differ either from a morphologic or surgical point of view. Weinberg and Seguin have noted a difference here, however. It is differentiated from *Bacillus putrificus*, because it possesses the appearance and greater part of its chemical characters in that it gives indol, and above all by its pathological action. Some authors also speak of similar anaerobic microbes isolated by Veillon and Zuber, found in different types of gangrene: *Bacillus ramosus*, *Bacillus fragilis*, *Bacillus Microc*, and *Bacillus parvulus*. These species are very difficult to separate, and of the chemical action of each very little is known.

But where did these species come from? It is an interesting thing that one always finds them grouped more or less together as associates, and more or less numerous following the intensity of the infection. Whatever the reason, one finds almost always the same microbes. Their common origin is animal matter (putrefactive) or detritus of food, and human or animal cadavers, mixed with the soil, the dust, and the mud. In order to better understand the action of these microbes on the wounds of our soldiers we will now seek to define the manner of their destroying a cadaver; that is to say, how they produce common putrefaction. Taking a fragment of muscle in a cadaver exposed to the open air, the chief element in the tissue is albuminous. The first microbes capable of attacking all of these materials ought to have mixed ferments; then when the hydrocarbons have disappeared, simple ferments will destroy the albuminoid matter. That is what happens. In the first phase of mixed ferments we see the aerobes appear, staphylococcus, *M. candidus*, *enterococcus*, streptococcus, *Diplococcus griseus*, *pneumobacillus*, and the *Bacillus coli communis*. They prepare the terrain; they deoxidize the mass. Then rapidly, at the end of some hours—12 to 24—the anaerobes appear—*Bacillus perfringens*, sometimes *Bacillus bifermentans*. Their action is lively, brutal, and rapid; the muscle loses its rose tint and becomes livid, swollen; between the muscles and muscular planes and throughout the length of the vascular sheaths small bubbles of gas

are produced, tearing apart the tissues. This production of gas gives a slight sulphurous odor. The microbial fermentation seems intense, muscular fibers are torn apart, and the fibrillae are separated one by one from their attachment to the sarcolemma on account of its liquefaction. The trypsin attacks the albuminoid substances and the serum-albumins, and the gelatines are liquefied first. The saccharolytic diastase destroys the glycogens and the lipase destroys the fats. At the end of some days another phase is produced—the phase of simple ferments. The important anaerobes (putrid) increase in numbers in their turn and now get into action. They are the *Bacillus putrificus*, the *Septic vibron*, and in its turn, the *Bacillus sporogenes*. At this time appears the real putrefaction. The tissues assume a darker hue, then become black. They become disassociated and make a frightful putrid mass. There are no more hydrocarbons and the diastatic action is now confined to the albuminoid materials. First the molecule is disassociated and albumoses, peptones, etc., are produced by these anaerobes. Second, the above-mentioned albumoses, etc., are now changed into amines. They may even commence destruction of the amines with throsin derived from phenol or tryptophane. Third, these residual substances, these incompletely destroyed amines are attacked by the microbes of the rear guard, great producers of ammonia, and are completely destroyed. These anaerobes are such as the *diplococcus magnus* or the aerobes, such as *Bacillus pyocyaneus*, *Bacillus proteus vulgaris*, *Bacillus griseus*, *Bacillus coli*, and *Bacillus* of pneumonia (Friedlander's).

As we shall see, each microbe preexists in the tissue, but it can not preponderate until the medium has become favored for it.

Such is common putrefaction. But if we open the tissue to the fresh air the anaerobes can not develop. They will be replaced by the aerobes—*Bacillus proteus vulgaris*, *Bacillus pyocyaneus*, *Bacillus mesentericus*. The action of the aerobes will be different. They will be less brusque, less strenuous, their action will be more insidious and a great deal slower. These actions will be more specialized. Each organism produces its acid action. The great proteolytic representatives will alone produce the destruction of the albuminal molecule. They will take it intact from organic tissue and change it into biurates or into amines or ammonias. We will also have the first phase of mixed ferments with that of candidus, staphylo- and streptococci, and a phase of simple ferments by *pyocyaneus*, *proteus vulgaris*, and *mesentericus*. There exists, however, one type of case in which putrefaction is frequent. It is in the skin of dirty, unkempt persons. The epidermal scales and secretions accumulate in the folds of the skin, where they ferment and putrefy. The same thing happens under the nails.

You will find here all the aerobic microbes of which we have already spoken some. They are the color of sweat of unclean persons. The blue and red sweats seem to be due to different varieties of *Bacillus pyocyaneus*. The *Bacillus cutis communis* belongs to the preceding group. It is a type which seems to have a special avidity for certain fat bodies secreted by the skin.

Now, gentlemen, we have studied the microbes of war wounds. We have seen from whence they come and what they are capable of doing without the body; and we will now see what they do within the living being. Let us study the pathogenic characteristics:

We know that microbes act in two ways; by toxins more or less fixed or adherent to the microbial body, and directly on the cells in the vicinity. But there are microbes that produce gangrene and those that diffuse their poisons to a distance, as those of tetanus. By inoculating animals with pure cultures of bacteria one is able to tell the nature of bacterial toxins.

Sarcinus, candidus, griseus, enterococcus.—*Sarcinus, candidus, griseus*, and *enterococcus* are not pathogenic. It is necessary with these to inoculate the animal with great quantities of the culture to occasion any trouble whatever; that is to say, saprophytes have only local action. All the other microbes are called pathogenic: *Staphylococcus*, *streptococcus*, *pyocyaneus*, *pneumo-bacillus*. When they reach the cells the phagocytes are poisoned, die, and form in the blood globules of pus. This action is visible and slow, as with *staphylococcus*, gold and yellow. *Pneumo-bacillus* acts in the same manner. The *streptococcus* has not only a local action but a general action; that is, it produces the diffusing toxin. Marnerec says that he has killed a rabbit with a thousandth of a cubic centimeter of culture. The other microbes have no toxic hemolysin. It is a microbe living very usually in the blood. It is a forceful

species on account of its action against neighboring tissues, its toxin action, and its hemolysin. The *mesentericus* and the *putreficus* destroy blood also by the action of tryptic diastase. *Bacillus pyocyaneus* is pathogenic and acts locally. It secretes also a curious diastase, *pyocyaneus*, which had the property of rapidly dissolving all cellular elements as microbes do in culture.

Living and bloody tissue is not a favorable medium for anaerobes. It is necessary that the soil be prepared first. The septic vibron kills easily, with the staphylococcus in 20 hours, with the streptococcus and the *mesentericus* in 6 hours. In considering the virulence, the *Vibron septique* becomes inoffensive when the aerobes are removed; you obtain the picture of gas gangrene described by Pasteur, sometimes a slow process, and phagocytosis is produced, and gas gangrene is abated, prevented by phagocytosis. Second, in tissue destroyed or digested by chemical action, *perfringens* or *vibrions* are killed incidentally. Third, by mixing in damaged tissue aerobes we produce exactly the condition of a war wound. This condition produced generally by the local action caused by the growth of anaerobes. The corpuscles are destroyed by hemolysin and the microbes produce a zone of dead tissue, the microbes will diffuse quickly while decomposing the killed cells by the tryptic ferment, and then, by a process of other actions of diastase, they make a veritable putrefied body. They extend like a spot of oil and stop at the articular plane. At last acute septicemia and death results.

The rapidity of the change depends on added aerobes, saprophytes. Staphylococcus and *perfringens* take one day; streptococcus and *perfringens* take one-half day. The aerobes have a great tendency to spread into the whole circulation and septicemia is then very quickly produced by the anaerobes, the last stage of the disease.

These, gentlemen, are conclusions of my personal researches. Do not forget, however, that other investigators have obtained the death of animals by injected cultures. I have seen guinea pigs die from subcutaneous cultures of *perfringens* in Gelose. Weinberg and Seguin say that they have killed guinea pigs with injections amounting to 1 or 2 cubic centimeters of liquid culture. I do not know the technique of the first experimenters, but I know that Sacquepee centrifuges the culture and injects the precipitate. He can then produce in this case a true chemical action in the living tissue that favors the growth of anaerobes. In finishing I want to call your attention to the series of experiments of Vaillard and Vincent on tetanus, cultures in which the diffusible toxin of Nicolaier's bacillus never developed. Young cultures in consequence of their youth do not produce a diffusible toxin. These bacilli follow the same development as the anaerobic Nicolaier.

It is necessary that the microbes have a favorable terrain to germinate in, in living, healthy tissue. Now remember well this last. It is a precious knowledge that will guide us when we attempt to cure our wounds of war. So in the destruction of dead tissue, as well as in an attack on living tissue, we see the microbes associated together. They aid one another in a fight where each gains his profit. As soon as one of them finds a suitable medium he increases and suffocates the others. In his turn he dies in the medium which he has destroyed.

In the next lesson we will study the growth of microbes in the wounds of war, the character that they impress on the wounds of war, and the surgical deductions that we will draw from this investigation.

In finishing, gentlemen, let me say that the greater part of the works that we have studied in this course of our researches—that is, the knowledge of anaerobes, the study of gas gangrene in distribution of bacterial flora action against microbes—these works are almost exclusively French, and it is with joy that I say they serve the most of cases.

SECOND CONFERENCE

In our first conference we have occupied ourselves solely with bacteriology, which was a subject which it was indispensable to consider in order to know better what will now follow. We have enumerated the different germs found in war wounds, at least in those parts of the front which were the theater of military action—Flanders and Champagne. We have studied the characteristics, chemical properties of these germs, and we know under what conditions they can be dangerous for the living organisms. We know their common origin; we have followed their evolution. This common origin is important in a study of putrefaction. This

putrid material is abundant all around human habitation, manure piles, débris of all kinds, etc. We had already noticed at the beginning of the war how differently wounds act when they are soiled and when they are contaminated. Those were exceedingly grave that had been polluted by the soil of stables or cattle sheds, which are receptacles of all kinds of filthy material. Later when trench warfare began these differences became greater. This first-line zone contains so many corpses and so many kinds of refuse that the wounds become, so to speak, uniformly infected. The weapons, the uniform, the skin were soiled dangerously by this earth. But putrid matter is not only found around us; it exists also in our interior and mucous membranes. Meat diet favors intestinal putrefaction, and it exists in animals and fowls. We find *enterococcus* and *Bacilli perfringens* in almost all individuals. *Staphylococcus*, *streptococcus*, *pyocyanius*, are exceptions. These are, to use the expression, pathologic germs, but each may be found in individuals presenting digestive trouble of slight character, and such people remain more or less germ carriers. We know how frequent these intestinal infections are amongst men who give little care to their elementary hygiene. Lax, notwithstanding all the advice and supervision they get, they are not very careful of their bodily hygiene. They are frequently soiled, and it is easy to understand that the second cause of infection is perhaps more common than the first. From a clinical viewpoint we can distinguish two kinds of wounds as putrid and purulent. The first to appear are putrid conditions; gangrene or gas appears. We hardly knew them in peace times. They were exceptional accidents occurring in cases of crushing. They have shown themselves from the beginning of the war extremely frequent and have caused numerous victims. Purulent conditions give a dirtier appearance. They are observed in hospitals in the lines of communication and the rear. We believe that putrid accidents can be divided into two categories: Localized forms and invading forms. The putrid process seems to localize around the wound. Tissues are pale, allowing blood like beef washings to escape, reddish brown in color, putrid in odor, and containing fine gas bubbles. The general condition is bad, the skin is pale, the pulse a little rapid, and the temperature reaches 30 to 38½. In the slightly progressive form the tissues appear washed out. The muscle takes the color of a dead leaf and between the muscular layers, in the fluid which looks like currant jelly, there is slight crepitation. The skin is pale, slightly yellow. It shows long streaks of brownish hue, giving a color that causes the name, trench lymphangitis. The skin is tense, sonorous. The general condition is bad, the pulse is small and rapid, temperature reaches 39, the patient is anxious, perturbed, and appears to suffer. In rapidly invading forms the muscle is likewise the hue of a dead leaf. When the wound is opened by incision the tissues have a washed-out appearance. The muscles are swollen; they bulge between the lips of the wound. The same edema, the same serous blood, and nauseating odor exists, but it seems to infiltrate the whole limb. The blood which is collected in a pipette does not coagulate any longer. The skin is tense and produces a special sound when it is scratched or when it is percussed. The streaks of lymphangitis are numerous and appear rapidly. In many forms the skin remains pale and we have to deal with the so-called malignant white edema, which is almost always fatal. The general condition is extremely bad. The pulse is thready, uncountable, the temperature reaches 39° or 40°. The patient is anxious. Death appears likely when surgical intervention is inadequate or delayed. Indeed, death may occur when the intervention is rapid and judicious. What is the flora in each of these cases? One may say that as a general rule the serous blood collected in the tissues are gorged with bacillary forms which culture reveals.

Germs of putrefaction.—In the localized putrid form we find in our Petri dishes or in ordinary agar tubes the following germs: *Sarcina*, *M. candidus*, *griseus*, *non-liquifaciens*, *enterococcus*, and *B. mesentericus*. All our tubes with deep inoculation show thousands and thousands of colonies of *B. perfringens*. Sometimes one also notices, but more rarely, *B. bifermentans* and *B. bavai*.

We see that this putrid process is not of long duration. On the third day the influence of phagocytes takes place. The putrid serous blood is replaced by a serous blood of a more reddish hue, more and more thick, more and more purulent in character. On the tenth day anaerobic germs disappear. But this is so only in case that our wounded man has been treated. If he has remained between the lines or has not been brought to the hospital in time, putrefaction will continue around foreign bodies, around fragments of clothing, in pockets

containing devitalized tissues, where we will find multiplication of our putrid organisms to which newcomers have joined themselves—*pyocyaneus*, etc. An abominable stench escapes from the wound, and on the fragments of putrid tissues we will find the development of fly maggots; fetid pus escapes from the wound. Gas abscess may form, but gas abscess is the end of a putrid process. It is an abortive form of gas gangrene process. The gravity of these wounds depends upon two factors:

First, the extension of the process up a muscle, or, better still, the extension through tissues which have lost their normal blood circulation. As we have seen in the course of our experience, anaerobic germs only develop while in tissues that are deprived of their normal oxygen; that is to say, a tissue deprived of its blood. Every obstacle to circulation increases largely the extension of the putrid process. The patient may die from the absorption of these putrid products, outside even of the absorption of toxins. The same effect can take place in wounds of hand grenades or by aerial torpedoes. Multiplicity of wounds produces an intensive result.

Second, or the other factor of gravity, is the intensity of the infection which can be appreciated by the great number of anaerobic germs. In light forms one only meets *B. perfringens*. In more serious cases one finds, besides, other mixed forms, such as *B. fermentans* and *B. Barati*, *B. putrificus* and *B. septicus*. All of these wounds contain *B. perfringens*. Every gas wound, every gas pus, contains *B. perfringens*. In not one case have I found in a wound from which escaped fine bubbles of gas only *B. mesentericus* and *enterococcus*. In these cases anaerobic germs develop in the crushed tissue when the multiplication is abundant; their zone extends slightly like a grease spot until phagocytes appear on the third day, but the pyogenic organisms associated with the anaerobic develops better in normal tissue; these extend further and prepare the way for the anaerobes. One can follow these two classified advances in the evolution of lymphangitis. First one has the course of the ordinary lymphangitis, giving to the skin a rosy hue. Then later the first is attended by a red or violet hue, spread in irregular curves. This is due to the anaerobes and the purpuric spots due to the hemolyses which it produces. If the surgeon intervenes he amputates in an apparently normal tissue and will stop the putrid process, but the lymphangitis will continue in the stump. This lymphangitis due to anaerobes is attended by a series of symptoms due to these germs. The tissues are tense, there is an abundant production of gas and destruction of the red blood cells. The process stops for a few hours at the level of joints where the same tense tissue seems an obstacle to its development. Naturally, the two factors of gravity which we have mentioned for the other form exist in this much graver form. They may terminate, as we said above, by the formation of a gas abscess, but their extension, more or less rapid, is always to be feared. In the rapidly invading form we find, also, the same anaerobic flora, varying likewise according to the intensity of the infection, but the real factor of rapid extension has not appeared to me to be due to one or another anaerobe but to the association of aerobes, in which we constantly found staphylococcus. Everything seems to bear the mark of this. The patient is depressed, his pulse is rapid, and his high temperature recalls what we have observed in grave staphylococcus infections.

It is easy to understand the gravity of the accidents which took place when one realizes that to the putrid and toxic action of the anaerobes is added the action of the streptococcus.

In the case of white edema, with a subcuticular discoloration of the skin, the destruction of red blood cells is very considerable and invariably death follows when the surgeon has not been able to excise and cut short anaerobic activity at its onset. One may operate and stop the putrid process, but one does not stop the streptococcal invasion and the patient continues to have fever and to run down in health in a manner characteristic of all streptococcal infections. These putrid indications, of which some are so grave, are relatively frequent in the hospitals on the front. Thus in Auto-chir No. 12 we were able to observe in June and July, on an average, in a hundred grave wounds 39 putrid infections due to anaerobes, with 10 cases of streptococcus and 9 cases of staphylococcus.

Aside from these initially putrid infections, we must say a word on the secondary ones. In the hospitals of the rear one can observe accidents simulating gas gangrene following surgical intervention—the removal of a foreign body or a piece of shell. I have been able to observe only one case in a hospital in Dunkerque. The bacterial flora was of that rapidly invading form, that is to say, association of *perfringens* and streptococcus.

Purulent conditions.—There are three categories: (1) Mucopurulent wounds; there is only a film of muco-pus covering the wound like a varnish. (2) Purulent wounds; the pus is more abundant, always thick, yellow in color, the edges of the wound are red and moist, there is a slight lymphangitis, and there is no fever. (3) Febrile purulent wounds; the pus is very abundant, and it has a tendency to extend, to dissect up surrounding tissues; borders of the wound present a livid aspect. In summer the patient is surrounded by flies which further contaminate the wound. It is to be noticed that in our putrid wounds when the anaerobes have disappeared they will take one of these three aspects.

Here, gentlemen, you can see three curves which are most characteristic. Let us now study the bacteriology. In muco-purulent wounds one can only find saprophytes. This flora is not very harmful. In the process of cicatrization very little pus is produced, but contamination by new species of organisms is insistent. This may occur from frequent dressings, the constant contamination from bedpans, sheets, hands of other patients and orderlies. In purulent wounds the flora is more complicated, and we find in more or less greater quantity staphylococcus.

The temperature begins to drop on the fifth day. In the fluids which soil the skin, in the squames of the macerated epithelium, we find the *pneumobacillus*, *B. cutis communis*, *proteus vulgaris*, and *pyocyaneus*. The wounds yield an odor of old urine when it is infected by *proteus*, a pungent odor when it is infected by *pyocyaneus*, and the gauze dressing is colored a golden or yellowish red with a greenish blue border according to the variety of the infecting bacillus. From the moment of their appearance in the wound these last two germs appear to occupy the stage. They appear to drive the others off. It is only after long weeks when the wound is almost completely scarred over that we note the disappearance of *proteus vulgaris* and *B. cutis communis*. Evidently every purulent wound has not such a rich flora. There are some which contain no *proteus*; there are some which contain no *pyocyaneus*. In some we find only staphylococcus, but they are rare. These secondary infections, notwithstanding what has been said, are almost the rule. In febrile wounds one always finds, alone or associated with the preceding, the true *Streptococcus pyogenes*. One may say that from the moment of its appearance in the wound this germ gives the wound and the patient a special character which does not mislead a trained observer. Local reaction, violent and rapid, with more or less extension of lymphangitis and infiltration of the surrounding tissue which stiffens the lips of the wound and gives it a livid appearance. General reaction is as violent as the local one. When you enter a ward containing streptococcus patients their appearance remains forever graven upon your memory. The evolution of this germ in the wound is also very characteristic. As you see, the descent of the curve is infinitely slow. The same secondary infections take place as in other infections—*pyocyaneus*, *proteus*, etc.

One finds it holds out to the last in the diverticula of the wound where it still abundantly grows. This germ is one that grows rapidly in blood owing to its hemolytic property. There are also two other tissues for which it has a special preference, joints and bones. Whenever a joint or a bone is in the neighborhood of the streptococcus, the slightest erosion, the slightest trauma is sufficient to open it a passage. Sometimes even one is puzzled to know if this infection can not take place without a preceding lesion. This invasion is always attended by a violent reaction, both local and general. Every joint that has been contaminated can be considered as lost; every bone that has been infected will keep for a long time—months, and even years—a trace of streptococcal infection. A wound of the soft parts contaminated by streptococcus will be attended by fever lasting 6 or 12 days; a wound of the bone will produce fever for 21 days, and an articular infection will produce an excessive series of fever lasting several periods of 21 days.

Army Sanitary School No. 64.

THE GENERAL ORGANIZATION OF THE MEDICAL SERVICES IN THIS WAR

By Col. B. K. Ashford, commandant

Gentlemen, you had an opportunity to visualize some of the problems and the manner of their solution at the British front, and have heard how these same problems are met by the French. Let us try, if we can, to consolidate our ideas, in view of what we have seen the exigencies of this war require. Three essentials in the medical services at the front stand out very vividly:

First. The collection of the wounded from the trenches, their conduction to the battalion aid post, and administration of first aid, and their forwarding to the ambulance head.

Second. The rapid, and as far as possible uninterrupted, conduction of these wounded to the first hospital on the battle field which can offer proper surgical conditions for treatment.

Third. The surgical treatment at a well-equipped hospital generally requiring definitive surgical intervention and retention until convalescence is established in time of relative inactivity, of surgical intervention on practically all seriously wounded—I would rather say in a large portion of the seriously wounded, and any such number of other selected cases as it may be possible to operate on, with generally immediate evacuation thereafter, during the strain of violent activity in which great streams of wounded pour in. This hospital corresponds to what we know as the "evacuation hospital" and should be on a spur of a railroad.

That is to say, the first problem is collection and first aid; the second, rapid and comfortable transportation to the rear; and the third, surgical intervention to avoid infection. The first two elements in previous wars were considered to be military necessities; the third, thanks to the new method of Lemaitre and the removal of devitalized tissue and foreign bodies and closure of the wounds, imposes upon all thinking men this third desideratum also as a military necessity, upon which depends whether the soldier is to rejoin his organization promptly and be fit to take part again in active operations or be sent to suppurate for an indefinite time in the interior and, perhaps, lose a part or all of his efficiency as a soldier.

FIRST. COLLECTION OF WOUNDED AND FIRST AID.

Our large battalions require two battalion surgeons—one free to accompany troops and be within call for special situations in the fire bay, and the other to remain on duty at his post in the aid station. At this station, the first place where the wounded man usually sees a surgeon, there should be a small case of instruments for emergency surgery, corresponding dressings, and such medicines as are necessary for the treatment of the ordinary medical conditions which may arise. Special features, however, should be noted. Dressings should be abundant and renewed at frequent intervals as per necessity from the field hospital; there should always be on hand Thomas splints, and every man should know how to put them on—knowledge to be acquired by drill—so that under the excitement of battle or in the darkness of the night the Medical Department soldier will be able to perform his duty mechanically. One of the most important of all the preparations for a wounded man at this station should be those providing for the prevention of shock, and the British system—three blankets on litter with stove underneath—is recommended as of universal feasibility. Lastly, this is the station par excellence for adequate gas protection and means of overcoming the immediate effects of gas.

We have seen how regimental surgeons seem to be keener on the gas situation than on any other thing that happens to the soldier and more than ordinary preparations should be made to have oxygen apparatus prepared; to provide for change of clothing, and for soap and alkali baths to get rid of the progressive effects of mustard gas.

Whatever may be the source of the stretcher bearers, 32 to a battalion is a bare necessity and provision should be made to run in 32 more in time of attack. Great care must be taken to get strong men and men of exceptional bravery, as there is no more exhausting work than stretcher bearing and no soldier should possess higher morale than the sanitary soldier. En route from the battalion aid station to the ambulance head, at some portion of the road, perhaps all of the way, both wheeled litters and narrow-gauge railroads are of utmost importance. Indeed, over these long stretches, especially where carrying by hand has to be done, relays of sanitary soldiers should be provided, the distance between them not being over a thousand yards. There is no wheeled litter better than the Miller-James of the English or the latest model of the French. Both are rubber-tired wheels and all steel. The Miller-James wheeled litter has the disadvantage of having pneumatic tires and the great advantage of being collapsible, allowing large numbers to be carried on a wagon.

The conduction from the battalion aid station should be uninterrupted, and it is very questionable whether the regimental aid station is needed or even justifiable; indeed, the ideal would be to have the regimental surgeon oversee the work of his three battalion stations

and attend to the evacuation of the wounded to the ambulance head, where he could see them get off in good condition and effect a liaison between the medical units of the regiment and those of the division at that head.

SECOND. EVACUATION TO THE REAR

The ambulance dressing station should be equipped to receive a sufficient number of patients and hold them for short periods in event of interruption to the line of communications. Indeed, near the battalion station there should be a forwarding station dugout manned by sanitary soldiers. At some points it appears evident that the function of the ambulance dressing station is chiefly summed up as follows: Protection during delay in forwarding and preparation for emergency treatment. Here antitetanic serum will often have to be administered, gassed cases treated, shock prevented or combatted, splints supplied, dressings readjusted, and men fed as well as given hot drinks. Two ambulances should be kept at all times at this station, where there should be at least two officers and such a number of men as may be necessary to handle the wounded coming in. There should be accommodations for at least 30 lying and 50 walking wounded. This is an ideal not often, unfortunately, possible to attain. There should be no undue waiting about to collect a load before starting when one considers that the chief object, once a man's shock is treated and he is prepared for the journey, is to get him into a surgical hospital where immediate operation may be done to avoid the consequences of infection. The ambulance used by the British, by common consent of all who hear me, is the best ambulance we have yet seen. Its motor is quiet and it is large enough to move about in, much larger than our own, which preserves all of the qualities of our original horse ambulance, but which has given us no more room to move about in. In fact, the British ambulance is a sort of a van and is well sprung. Above all, I wish the officers to bear always in mind the perfect condition of repair and the orderly cleanliness of these machines at all times. They all look as if they had just come from the shop, and some of the brightest and best looking of all, we were told, had been running three years. This means hard work on the part of the team assigned to running the ambulance. We have heard that there is no excuse for a dirty ambulance, and whenever the ambulance stops the man sets to work to clean it up immediately; it is the first thing he does in the morning and the last thing he does at night, no matter how late it may be. We have seen the horse ambulance as well. I don't believe in all my life I have seen transportation in such beautiful condition. The matter of transportation to the rear is a very important one, and one of the three links in the great chain that make for the salvage of wounded men.

Concerning the evacuation of wounded, the British hold that there are no nontransportable cases, on the ground that once a wounded man reaches the ambulance head he has already passed through the worst part of his trip to the rear. He can not be kept at the battalion dugout, and once at the ambulance head a half or three-quarters of an hour more in a comfortable ambulance will not injure his chance for recovery nearly so much as to retain him where he can not be properly treated in time to prevent infection or in time to perform operations which are manifestly impossible at the front. The English state that they have tried out special surgical hospitals near the front and save in rare instances, where they could be put in quarries and tunnels or caves, they have been failures. It was stated to us on no less authority than the chief surgeon of the First Army that surgeons can not properly operate on a patient under shell fire, nor can any considerable number of badly wounded men be provided with sufficient surgical matériel when fallen on the battle field. They, therefore, do not call a man nontransportable until he reaches the casualty clearing station, which corresponds to our evacuation hospital, which they have recently placed at a distance of not less than 12 km. from the line. They believe, as necessary transportation from the trench to the ambulance head has been done, that the only considerable thing that would prejudice his condition has already been done, and that that which remains is much better than to leave him at the front in a hospital which must always be manifestly inferior in equipment and infinitely more dangerous. The French still try, where possible, to provide some sort of surgical equipment in men and matériel for the wounded man while still under fire, and the answer for us is practically that in cases where humanity demands such an advance of a surgical hospital it should be in the shape of a motor, portable operating,

and radiological equipment, which should be sent to the front only under conditions of great stress. Anything which interrupts in the ordinary course of events the prompt transportation of a wounded man from the first-aid station to the first hospital where he can be treated under modern surgical conditions is in principle wrong. Moreover, the scattering of special hospitals, as has been attempted by many humanitarian physicians and surgeons, all over the battle field should bring to our minds that each one of these hospitals has to be equipped and manned and requires a separate and distinct line of evacuation and multiplication of ambulances. The watchword for us to-day should be to get our patients back, within eight hours at least, to the place where they may be finally operated upon and wherever possible retained until convalescence or until they can be safely moved, a rule which must be modified only in time of great activity, a time which does not occur more than 2 weeks out of 52 in the lives of most divisions.

We come, therefore, to the third essential, the evacuation hospital. Roughly speaking, this should have 2,000 beds per 25,000 troops. Operative cases, with primary suture, débridement, require that they be kept a week to 10 days at least. There should be special wards and special teams for fracture cases, chest cases, abdominal cases, and the ordinary wounds of soft parts. It is better to have any special hospitals which may be created in the rear of the evacuation hospital but within reach by motor from this hospital. Especially important are hospitals for fracture and brain cases.

The utilization of the field hospital of the American Army is best translated in trench warfare into a hospital for sick and gassed cases, and perhaps at times and under certain conditions war surgery can be done, with the exception of the slightly wounded, which it is better ordinarily to send to the evacuation hospital. These field hospitals can be nearer the front and should receive their patients direct from the ambulance head. Brain cases should also go direct to their hospital.

Before closing, only a few words on the subject of convalescent depots. The duty of the Medical Department in war is now clearly understood. The humanitarian calling of a medical man must always influence every act, in civil or in military life; and in the application of the medical services to the war, the part of the medical officers of the Army is that they constitute the salvage corps for men.

Patients who reach the stage of convalescence and are able to leave their beds, instead of being sent to some hospital farther into the interior, should be sent to a convalescent depot commanded by medical officers, and gradually reconstructed into fighting men by exercises and games. Use every possible means to induct the men out of the convalescent frame of mind into the enthusiastic military spirit. Bands of music are a help. The companionship of the courageous men, above all, preserves a military atmosphere. Line officers should not be in command of the military exercises; you should use noncommissioned officers under the supervision of two or three medical officers. The convalescent depot is one of the greatest contributions of the Medical Corps to the effective force of the Army.

Army Sanitary School No. 65

THE USE OF DAKIN'S SOLUTION, DICHLORAMINE-T, AND EUSOL IN THE TREATMENT OF SUPPURATING WOUNDS

Lieutenant Wyant, at Lieutenant Colonel Keller's hospital, January 11, 1918

In the treatment of wounds I wish to mention the use of the chlorine containing solutions as eusol, Dakin's solution, and "dichloramine-T."

The preparation of the dichloramine-T oil embraces three steps:

First. The solvent eucalyptol (U. S. P.) is chlorinated; 500 c. c. are treated with 15 gm. of potassium chlorate and 50 c. c. of concentrated hydrochloric acid for 12 hours or longer; then well washed with water and sodium carbonate solution. The water is drawn off and 15 gm. of dry sodium carbonate are added to the oil and the whole is allowed to stand for 24 hours. The oil is filtered off, dried with a little solid calcium chloride when it is ready for use.

Second. The paraffin oil is chlorinated. To 500 c. c. of concentrated paraffin oil, 15 gm. potassium chlorate and 50 c. c. of concentrated HCl are added and the mixture exposed to light, preferably sunlight, for several hours. It is then transferred to a separating funnel and washed successively with water, a solution of sodium carbonate, and again with water. The opalescent oil is drawn off, sodium calcium chloride added in small quantities, and about 5 gm. of animal charcoal. On subsequently filtering through paper, a yellowish oil ready for use is obtained.

The third step is the preparation of the oil solution of dichloramine-T for use in the spray; 0.2 gm. of the dichloramine-T is dissolved in 2 c. c. of the chlorinated eucalyptol without heating. When the solution is complete, 8 c. c. of the chlorinated paraffin oil are added. After mixing, the solution is ready for use. The solution contains 2 per cent dichloramine-T and is relatively unstable and should be discarded as soon as a distinct precipitate makes its appearance. An opalescence or moderate cloudiness is not evidence of material deterioration. It is a safe rule not to use the completed solution for more than three or four days after its preparation. It should be protected from strong light and is best kept in a cool place. Where large quantities are needed, a stock of 10 per cent solution of dichloramine-T in eucalyptol may be prepared and kept on hand in a cool dark place for dilution with the paraffin oil 1:4, as required. The eucalyptol solution will suffer little deterioration in a month.

It is best applied by an oil spray, an ordinary hard rubber or all-glass atomizer being the most practical method. Metal atomizers are not suitable since the metal is attacked by the chlorine. This oily solution presents the first great advantage—the dressings do not stick to the wound and the entire act of dressing is relatively painless. The gauze does not have to be separated from the granulations by soaking; the old dressing is simply lifted off and the wound sprayed; the force of the spray will dislodge the sloughs, and the wound is covered with a fresh dressing. It is evident that a very important saving of time results from this simplicity of dressing.

The solution contains enough available antiseptic so that one dressing every 24 hours is ample for large deep wounds, and one dressing every 48 or 72 hours is enough for the simple or more superficial wounds. The oily solution creeps into all the wound crevices and corners, and it can be readily introduced into sinuses by means of a cotton swab dipped in the solution. The preparation is not irritating to the skin of mucous membrane, except possibly to the rare individual who possesses an idiosyncrasy to the eucalyptus oil. The points in favor of dichloramine-T in solution in eucalyptol and paraffin oil in wound treatment are: The elimination of the Carrel tubes; the time taken for the periodic flushings as necessary in Carrel-Dakin application; the rapidity with which a surgeon can dress his cases; the appreciable saving of dressing material; the lessened amount of pain of wound dressing.

In the use of eusol the same technique is employed as with the Carrel-Dakin treatment. In the preparation of the solution we take 135 c. c. of the B. P. liquor calcis chlorinatæ; dilute with water 1 liter, add 10 gm. of boric acid and shake until dissolved. The solution remains clear and without further treatment is ready for use. If preferable, a saturated solution of boric acid may be stocked at room temperature. This contains 4 per cent of boric acid; therefore 250 c. c. give the amount required for 1 liter of solution of eusol. In making eusol this way, the 135 c. c. of liquor calcis chlorinatæ should be diluted to 750 c. c. and 250 c. c. of boric acid solution added. This prevents the formation of the precipitate which occurs if boric acid be added to undiluted liquor calcis chlorinatæ.

By this method eusol can be prepared at a moment's notice by diluting and mixing two stock solutions, both of which are stable.

The Carrel-Dakin treatment is the introduction into the wound of a hypochlorite solution in sufficient amounts and strength to retard the growth of bacterial flora and produce progressive sterilization in the wound if possible.

The solution used is Dakin's, consisting of:

Chloride of lime.....	200
Dried carbonate of soda.....	100
Bicarbonate of soda.....	80

and water enough to make 10 liters of solution. The 200 gm. of chloride of lime are placed in a bottle with 5 liters of water and shaken well at several intervals, then allowed to stand overnight. The carbonate and bicarbonate of soda are dissolved in 5 liters of water in another container and then the solution of the soda salts is turned into the bottle containing the solution of the chloride of lime. This is shaken vigorously and then allowed to stand for a few minutes in order to allow the carbonate of lime to settle to the bottom. The clear fluid is then siphoned off and filtered through filter paper to obtain a perfectly clear solution, which is now ready for surgical use and contains about one-half of 1 per cent of sodium hypochlorite with small quantities of neutral salts of soda. No heat is used in the preparation or in the use of the solution. It must be freshly made and kept from the light in well-corked bottles.

It is a neutral solution and markedly isotonic to blood serum. Marvelous results are obtained with this solution upon infected wounds, especially if used before the suppuration is well established, and even then it shortens the suppurative period, rendering the wound almost germ free in a comparatively short period.

In changing the dressing, careful attention to details and antiseptic precaution is necessary, and for this reason we observe our technique as carefully as in an abdominal operation. Two pairs of dressing forceps are used to handle the tubes and dressings. Rubber tubes of size No. 7 tubing, and about 10 inches long, are used to carry the solution into the wound. The distal end of the tube is closed with a ligature with numerous lateral small openings perforating the tube for about one-half the length. The part of the tube with the perforations in it is buried in the wound and held in place with a small piece of gauze dampened with the solution. The proximal ends of the tubes coming from the wound are held by the assistant who connects them up to a glass distributor, which in turn is attached to a larger tube, which brings the solution from a bottle hung at a convenient height to allow instillation into the wound. The number of tubes employed as well as their size is determined by the size and extent of the wound, as well as the amount of infection. The number and intervals of the irrigations being regulated by a stopcock on the main tube. It is necessary for the solution to come in contact with every corner of the wound, so just enough fresh solution is allowed to gravitate to the wound every two hours to flush the tissues and keep the dressings moist. Several layers of gauze moistened with the solution are placed on the outside of the wound as a dressing, and a large pad placed over the whole to absorb any superfluous solution which may have come from the wound.

In large superficial areas, as many tubes as deemed necessary are placed on the surface of the wound, being held in place by gauze saturated with the solution. The proximal end of the tube is fastened to the skin with adhesive at a safe distance from the wound.

In case of wounds involving the pleural cavity, a drainage tube is inserted with the Carrel's tubes to permit a return flow of the fluid and discharge. In case of excessive coughing due to the irritation caused by the fluid, the irrigations are temporarily discontinued.

We continue the use of the solution until the discharge is of a mucoid nature and a smear shows one organism in from 3 to 5 fields. After we discontinue the irrigations, we dress the wound every day with a dressing saturated with the solution.

The solution may have an irritating effect on the skin of some patients, but this can be avoided by applying sterile vaseline around the wound when changing the dressing.

Army Sanitary School No. 66.

GENERAL PATHOLOGICAL ANATOMY AND PHYSIOLOGY OF WOUNDS—SPONTANEOUS EVOLUTION: HEALING PROCESS

By M. le Medecin-Major Policard

SUMMARY: A STUDY OF SPONTANEOUS EVOLUTION OF A SIMPLE CUTANEO-MUSCULAR WOUND DUE TO ANY MISSILE

I. The first stages of wound evolution

a. Various elementary forms of pathological changes due to physical causes; mechanical resistance of tissues; mechanical elasticity; distant hemorrhages.

b. General conditions in a recent wound; lesions affecting epidermis, derm, hypodermis, and muscle.

c. The wound during the first hours; latent period; mortification; phenomena in those tissues where circulation is absent; arrival of leucocytes; limiting zone between dead and living tissues.

d. First microbial growth. (Refer to lecture on bacteriology of wounds.)

II. Cleansing of wound

a. Physiological mechanism in the spontaneous cleansing of a wound; proteolysis of dead tissues.

b. Proteolytic agents; essential part played by leucocytic ferments; secondary importance of autolytic endoferments.

c. Result of proteolysis; toxicity of proteolytic products, their elimination. Such products are the culture medium for wound microbes.

d. Limitation of proteolysis due to periphery of wound; separation between dead and living tissues.

e. The importance of the cleansing period, which is that most liable to gangrene. Surgeons, as much as possible, ought to avoid spontaneous proteolysis by the surgical removal of mortified tissues. Such tissues are a culture medium for microbes.

III. Filling in and closing of wounds

a. An essential point is that muscles and tendons do not regenerate. Necessity of filling in the wound cavity with a special connective tissue; i. e., granulation tissue.

b. Internal structure of granulation tissue; surface layer of embryonic character, with numerous cells; deep layer undergoing fibrous transformation; rectilinear masses of capillaries giving individuality to each granulation.

c. Deep sclerosis. In the deep muscular planes of a wound an internal sclerotic process is developing more or less actively. Origin and practical importance of such sclerosis.

d. Epidermis covering the wound surface; histological changes; relation between epidermis and underlying granulations.

e. Pathology of the granulation tissue; edema; leucocytic invasion; vascular alterations.

IV. The scar

a. Structure; epidermis; fibrous masses; vessels; sclerotic zone under scar.

b. Scar physiology; connective tissue shrinking; imperfect circulation in scar, and consequences.

V. Practical deductions derived from the above data

a. Dangers during the proteolytic stage; physiological basis for surgical cleansing of wound; mortified tissues govern growth of microbes; part played by this culture medium; toxic symptoms in the wounded during war time.

b. Infected foreign bodies remaining in wounds; latent infection in cicatrices.

c. Granulation tissue, origin of sclerotic masses. Its production is, as much as possible, to be avoided (primary or primo-secondary sutures); otherwise, surgical intervention has to be resorted to. Physiological rebuilding of anatomical layers in suturing wounds.

GENERAL PATHOLOGICAL ANATOMY AND PHYSIOLOGY OF WOUNDS.—THEIR SPONTANEOUS EVOLUTION: HEALING PROCESS

In this lecture, M. Policard confines himself strictly to the histological anatomy and physiologic processes of wounds of war. He stated that we must consider, first, the ballistic state in the formation of wounds. First, the direct effect of the ball, and then the indirect. A great deal depends upon an accurate knowledge of the histology of the skin. The skin is an elastic organ and is put on the stretch by the missile, and while on the stretch the missile slips through, generally leaving a hole smaller than its diameter. On reaching the subcutaneous tissue, however, its effect is more extensive, the hole being larger than the projectile, and pieces are liable to be blown tangentially and vessels in the path of the bullet are torn, which bleed and cause hematoma. It then slips through a hole in the aponeurosis the size of its diameter, shredding the edges. Underneath the edges of this aponeurosis, pieces

of clothing are apt to be deposited. On reaching the muscle, which is filled with fluid, cells at a great distance from the path of the bullet are killed by molecular shock, a true explosive effect. Many of the vessels are torn and there is a great deal of bleeding. There is thus a large chamber of attrition where pieces of skin, foreign bodies, and dead tissues are inextricably mixed. The tissue in which the projectile comes to rest has lost less by molecular shock in this locality than in that surrounding the tract through which the projectile has passed, as by this time its force has been spent. One should not lose sight of the fact, also, that the skin itself may be found deep in the wound, it is blown in ahead of the projectile. In the muscle beneath the torn aponeurosis there is wide destruction, and this chamber of attrition, filled with dead and devitalized tissue, foreign bodies, etc., is the seat of the digestive processes which are nature's method of cleaning the wound.

After the twelfth hour three distinct phenomena are noted and they come together: (1) Multiplication of microbes; (2) collection of leucocytes; (3) transformation of these leucocytes into globules of pus.

It is well known that the albuminoids, even the most complex, are constituted by the union of muscles of aminic acids, which should be considered as the foundation stones of the albuminoids. These amines have a chemical constitution which is rather simple. They are crystallizable, dialysable, and not toxic. They group themselves into infinitely varied types of what are known as polypeptides, and as later they lose their crystallizable and dialysable characters they become colloids. The peptoses and peptones, with all of their varieties, still little known, are the ultimate intermediaries between the polypeptides and the albuminoids, but contrary to the aminic acids they are very toxic.

Let it be understood that before tissue is digested it has to be coagulated. In fact, this happens always in digestion. Proteolysis is the phenomenon of digestion of this coagulated substance, which breaks up the albuminoid molecules and produces some aminic acid, but much more peptone and proteose, which in their turn are broken up more and more until they become less and less toxic. Fibrous and elastic tissues are resistant to this proteolytic action.

This proteolysis is due to diastases. Some of them directly destroy the albumin molecule, breaking it up into aminic acids, but some only carry the process as far as the peptones, from which they are attacked by other ferments which are peptolytic. These proteolytic diastases are more active the nearer the temperature gets to 40° and the process can be almost stopped by placing ice over the member. Above 60° and 70° these diastases are destroyed. We may explain thus many clinical results in the employment of hot air and heliotherapy. Water is indispensable to the progress of fermentative action. In a dry wound you do not get proteolysis. It is produced especially in mediums free from oxygen, and the reaction of the medium should be within certain limits. Antiseptics have no action on this phenomenon.

The sources of the proteolytic diastases in the wounds of war are various: First, the tissues furnish them themselves. This is known as autolysis, but it has a very feeble rôle in the evolution of the wounds of war when one compares it with that of the leucocytes or microbes and, besides, it is a slow process. Second, the only great agent in proteolysis in wounds is the neutrophilic polymorphonuclear leucocyte. This leucocyte produces some extremely active proteoses which seem to work best in an acid medium, although some prefer one which is alkaline. They are not specific, but are very energetic. The maximum amount of proteoses is produced by the rupture of normal leucocytes. Third, the plasma of the blood and the lymph has some proteolytic qualities but these proteases are weak. Fourth, the microbes in wounds are important agents of proteolysis, especially the anaerobes, but the real agent in the cleaning of the wound comes from the polymorphonuclear leucocytes.

This proteolysis sets free acids which on being absorbed contribute to shock. But proteolysis, useful at the beginning, is extremely harmful when reparation of the tissues begins. At this time the infecting organisms are aerobic and these have little or no proteolytic action. On the contrary, that of the leucocytes is powerful, a harmful influence that nullifies their phagocytic action. Poliard has demonstrated that the vitality of granulations is in inverse proportion to the number of leucocytes they possess. These leucocytes are the cause of necrosis of granulations. There is a direct relation between the amount of pus and the volume of granulations which when the first is increased are edematous, full of leucocytes and in process of destruction. These phenomena of necrosis are all the more intense when the

leucocytes are dead. The deduction to be drawn from this is that we should preserve the life of the leucocytes to get their phagocytic effect and prevent their death which results in an outpouring of destructive proteases. For this reason antiseptics are to be shunned as they kill leucocytes and isotonic bland solutions should be employed to wash wounds.

As a matter of fact, the wounded are far more intoxicated than infected. We are just coming to realize the importance of the toxicity of proto-albumoses in producing a proteose intoxication. These phenomena are at their maximum in gangrenous processes, when to all this is added the incomplete proteolysis caused by anaerobic organisms.

It looks even as if the excellent effect of Dakin's solution was due in great part to the oxidizing of the proteoses by the hyperchlorites rather than simply to a bacteriocidal action.

All these phenomena of proteolysis are counterbalanced by the antiferments, on a basis of lipoids, especially of the nonsaturated series of fatty acids, and their cleates. In the blood, normally, these fatty bodies prevent proteolysis. But if they are suppressed the proteolytic ferments are unmasked and come into play, with digestion of proteins and proteose intoxication. In this fashion the phenomena of anaphylaxis, the "crises" of acute diseases like pneumonia and the terminal scenes in starvation, have their explanation. These antiferments are of great importance in also explaining the resistance of sound tissue to proteolysis. It is easy to demonstrate the fatty character of gangrene tissue which makes proteolysis more difficult and which favors the production of peptones and toxic proteoses. There comes a time, suddenly and without the influence of any therapeutic agent, that this fatty degeneration is inhibited and these fatty tissues are transformed into liquid pus; the phenomena of proteolysis reappears and the fatty barrier is digested and liquefied.

The anaerobic bacteria accommodate themselves to their new surroundings and thrive on the dead tissue as soon as the aerobes have used up the oxygen. All of this digesting mass is a fine medium for anaerobes and it is necessary to operate in order to avoid this condition, to do what nature does, separate the live from the dead tissue. The natural way is for the leucocytes to collect at the head of circulation of the blood, near the devitalized tissue. At this point, therefore, are found the cells that secrete a substance which is proteolytic. This natural method of cleaning the wound is a dangerous part of the process for the patient, for it is here that gas gangrene begins. The surgeon should cut out everything destined to die.

Muscle does not regenerate. This inner area occupied by dead tissue must be filled, and there are two elements only that take part in that process—connective tissue cells and epithelium.

The connective tissue cells which are embryonic in the outer layer of the conical wound are developed into connective tissue fibers as one goes deeper. Into this mass little branches coming off at right angles from underlying vessels are pushed out and form loops covered with embryonic connective tissue, forming the so-called budding layer or granulation layer. The ultimate destiny of these embryonic cells and the enormous number of small vessels that feed them is that the cells become connective tissue cells with fibrils, and the majority of the right-angled vessels tend to disappear. As this takes place there is a shrinkage. At the level of the skin the destroyed derm is not replaced, but the epithelial edges of the wound run over this sclerotic tissue.

The vessels of granulation have almost no anastomoses. As soon as the skin covers over the wound all the vascular connective tissue growth ceases and process of sclerosis begins and invades all the granulation tissue up to the epidermis before there is a decided regression of the vessels, in which the majority disappear. The former presence of these vessels is only indicated by the bundles of connective tissue, whose cells, in embryonic form, once covered over the vessel and which persist now in the fibrous tract seen perpendicular to the wound. These bundles are the thicker the longer the granulation is continued. Finally, the connective tissue grows no more and a third phenomenon begins, the retraction of the fibrous tissue. The result is that the shrinking of the bundles, which are tangential, brings the lips of the former edges of the wound together and puckers it, and the shrinking of the perpendicular fibers tends to depress the scar. The worst of it is that not only does the increase in the connective tissue take place in the site of the destruction caused by the wound, but that activity extends inward and invades the muscle, which produces an interstitial sclerotic myositis. In the end this connective tissue may even ossify in the muscle.

Now, it is not only necessary to cut away the dead tissue, to take away the food which anaerobic and other germs need to feed them, in order to prevent the phenomena of infection, but it is necessary to prevent that fibrous mass forming between the lips of the wound by uniting skin to skin, muscle to muscle, etc. Granulation tissue should be avoided and its effects in binding down muscle in pressing on arteries and nerves may be avoided. Besides, the granulation tissue is poorly nourished as a rule and is liable to break down and be a weak spot, not to speak of a latent infection in the scar where some microbes may be entangled in the process of healing.

Army Sanitary School No. 67.

TETANUS INFECTION

By Medecin-Major Lecene

SUMMARY

Since the war we have learned new facts concerning tetanus, chiefly from the clinical point of view. Before the war we did know that:

1. Tetanus is, like diphtheria, essentially an intoxication.
2. The tetanus anaerobic bacilli are abundant in the manured soil.
3. The tetanus bacilli grow only at the site of inoculation and produce there a soluble toxin.
4. The tetanus bacilli are highly favored in their culture in the broken and uneven wound by association with pyogenic bacteria and by the presence of a soiled foreign body (implantation infection).
5. The tetanus toxin travels from the point of inoculation up the nerves to the central nervous system, although it is also diffused to some extent by the blood and lymphatics.
6. When the toxin is fixed like a dye, on certain groups of nerve cells (the motor nuclei of the spinal cord, and medulla, and perhaps, too, the motor cortex of the brain) the symptoms appear.
7. A certain latent period elapses before the symptoms appear, and the longer this incubation period lasts the less serious is the disease.
8. The acute cases, beginning around the fifth or sixth day after the inception of the wound, are almost sure to end fatally.
9. The effect of the tetanus toxin is to produce extreme rigidity of the musculature of the limbs, always preceded in the acute cases by clenching of the jaw (trismus) and stiffness of the neck, followed by contractions of the muscles of the back.
10. Reflex or spontaneous convulsive attacks of great violence occur in the severe cases.
11. When the muscles of respiration (and perhaps, too, the bulbar cardiac centers) are involved, death ensues.
12. In the acute cases, the mortality of tetanus is very high, about 80 per cent.
13. In some cases the incubation is prolonged (two or three weeks) and the course of tetanus infection is subacute and much milder (about 30 per cent mortality).
14. In some rare cases the tetanus remains localized to the head (cephalic tetanus) with trismus and facial paralysis (difficult to explain).

The numerous cases of tetanus observed during the first months of the war showed us that three new clinical forms of tetanus should be described:

1. *The delayed form of tetanus* in which the symptoms of tetanus appear only after a long time (two or three months after the injury). This delayed tetanus can be mortal, but it is not so severe as the acute form (about 40 per cent).

2. *Local tetanus*.—This form was very well known experimentally but almost unknown or illy described in man. The pathogenies of this local tetanus is very easy to explain: The toxin is fixed only in the motor cells of the spinal cord corresponding to the motor nerves of the wounded region (upper or lower limb, or, much more rarely, the abdominal wall). In this local tetanus it is very frequent to observe the absence of trismus. Local tetanus can be observed in the period immediately following the wound, like acute tetanus. It remains localized. Its severity is certainly less than that of the acute generalized form, but it is, however, often fatal (about 40 per cent).

But the most curious form of local tetanus is the delayed form. It can occur one or two months after the wound. The prognosis of this local delayed tetanus is not bad, but it can be enduring and produce muscular and tendinous retractions. The diagnosis of the delayed and local forms of tetanus is not difficult if you are well aware of the existence and relative frequency of those clinical forms.

The treatment of tetanus must be chiefly preventive.—The prophylactic treatment is grounded on two bases, equally important and consequently inseparable: (a) The local, surgical treatment of the wound; (b) the immediate injection of tetanus antitoxin (10 c. c. soon as possible after the injury and again in 10 days if wound remains soiled and suppurating)

With the combined and systematic use of these two proceedings the frequency of tetanus infection is now very low. When the symptoms appear, the tetanus antitoxin can no more counteract the fixed toxins, but can be yet useful to neutralize the toxin which can be again produced in the wound. The subcutaneous or intravenous injections of antitoxin in these cases are preferable to the very difficult and not more effective intrarachidian injection.

We possess numerous and certainly useful drugs against the declared tetanus infection; they are chiefly useful in the milder forms of the disease. Among the drugs we can mention: (1) Ingestion per os or enema of chloral, 8 to 10 gm. per day during 18 or 20 days; (2) subcutaneous injections of $\frac{1}{2}$ per cent of carbolic acid per day during 10 or 15 days; (3) intravenous injections of 20 c. c. of a 5 per cent solution of persulphate of soda per day during 8 or 10 days.

TETANUS INFECTION AND THE SEROTHERAPY OF TETANUS

Since the beginning of this war we have learned considerably more about tetanus, but the knowledge we have acquired is chiefly clinical, the bacteriological and serological knowledge being already complete. Before the war began we knew that tetanus was like diphtheria in that it produces a diffusible poison. To achieve tetanus infection the bacillus needs to be introduced under the skin, but its activities are favored by the presence of aerobes which use up the oxygen in the locality. In fact, this combination with aerobes should be looked at in the same light as that known to be favorable to other anaerobes.

The tetanus bacillus was discovered in 1884. Infections take place much more commonly when men operate over soil that has been lived upon for many hundreds of years. In the South African War the English found very little tetanus because it was rare in the virgin soil where they operated. The incidence of tetanus to-day among the French is about one-tenth of 1 per cent, because all wounded men receive the antitoxin promptly after injury as a prophylactic measure. At the beginning of this war its incidence was many times greater because of lack of this serum. The tetanus bacillus does not cause a septicemia but an intoxication. The nerve cells of the central nervous system are the only ones which have receptors for this toxin. They are chiefly those of the motor group in the cord, but the bulbo-spinal nuclei are especially susceptible; it is probably also bound to the cells of the motor area of the brain also. In fact, some think that general convulsions in tetanus depend upon involvement of cells of the cortex. Tetanus toxin is carried in the axis cylinder of the nerve directly upward from the point where it is produced to the nerve cell, but it is also carried in the circulation directly to that nerve cell.

The antitoxin of tetanus acts only as a prophylactic, and it should not be considered a means of cure of a developed case inasmuch as the poison is already bound to the nerve cells and can not be dislodged. Its only application as a therapeutic measure is in those cases where tetanus bacilli still exist at the point of their introduction and still produce their toxins. Injection of antitetanic serum will counteract a certain percentage of these toxins which are circulating in the blood and prevent additional damage to nerve centers. It should not be injected intraspinally or into the ventricles of the brain, as once recommended. The American serum has twice the strength of the French manufactured at the Pasteur Institute, but with a greater tendency to produce anaphylaxis. As a matter of fact, however, in this war anaphylaxis plays no important part and should be disregarded unless there is time to inject small quantities before the massive dose to test the susceptibility of the patient. This time is usually not obtainable inasmuch as the wounded should receive it always as soon as possible in the first-aid station or at the ambulance head; certainly at the field hospitals or the evacuation hospital on arrival. All patients having received this serum should have a "T"

marked on their foreheads with indelible pencil or some dye. Men with multiple wounds require a greater dose than those with simple wounds, and they should receive it every 7 to 10 days for four doses. All patients secondarily operated upon should receive tetanus antitoxin, as well as those who have been burned or who have advanced forms of trench foot. Injury to old wounds or damage to sites of fractures caused by gunshot wounds, whether accidental or surgically produced by secondary operation, is liable to light up tetanus again due to the liberation of latent forms in the interstices of the scar.

The clinical signs of tetanus are not so frequent now; injection of antitoxin has created a relative immunity in those cases in which tetanus develops, as a rule, and we find the most aberrant clinical forms, forms once rare, very difficult to diagnose and requiring an acute clinical sense which we must develop as rapidly as possible.

Acute tetanus in a nonimmune subject will be found to be a febrile disease. It has an incubation of five or six days and is very fatal, with a mortality of at least 95 per cent; it can be afebrile. The fever is probably due to the involvement of the thermic center. The longer the incubation of tetanus the less dangerous it is, however. The incubation period of tetanus may be lengthened by artificial immunity to 700 days, during which time the bacteria may lie latent in the tissues and are only awakened to activity by an injury which may be very slight. This incubation period is a perfectly silent one. Wounds of the face produce a violent form of tetanus and are very dangerous, with a mortality of not less than 80 per cent. In this latter case (cephalic tetanus) there is early trismus, and rigidity of the muscles of the neck due to early and intense involvement of the bulbo-medullary centers. The point of origin of the toxin is usually in a wound of the head and causes also paralysis of the facial and cranial nerves. In tetanus, dysphagia is a most important and early sign and much more reliable than trismus. The so-called hydrophobic form is a misnomer. It is due not to a fear of water but to an inability to swallow. Death occurs in acute cases in 10 days as a rule. It should not be forgotten that while tetanus patients are usually conscious, there may be maniacal delirium in very acute forms. The action of the toxin is that of a diastase. The cephalic form, with trismus, is a peculiarly fatal one. There is a suspension of reflex reciprocity of governing nerve centers for muscles. He explains the term "reflex reciprocity" in the following manner: The stimulus which travels to the center and which should produce a normal reflex calling forth action of certain muscles in an orderly manner is vitiated. Ordinarily in such normal action there is an excitation of the proper center and an inhibition of opposite centers controlling contrarily acting muscles. The result is, normally, that one set of muscles is relaxed to allow another set to act, but in tetanus this reflex reciprocity is destroyed by an abrogation of this inhibition and the stimulus acts upon the opposite centers as they do upon the center they should normally act upon alone. The consequence is a spasm of all muscles at the level of the cord or brain affected, a familiar example of which is the "lockjaw." Dysphagia is also explained in the same manner.

The result of this action upon nerve centers produces hypertonicity of muscles, causing intense pain and punctuated by clonic spasms, which are due probably to irritation of the cortical centers of the brain. The action of the contrary muscles also enhances this pain. Death from asphyxia is slow and not sudden. Death said to be from failure of the heart does not come from a direct action on the heart muscle but the heart literally runs away. Sweating is free in tetanus and the temperature is usually in the ordinary case, around 99; the pulse is below 100 until toward the end. Lecene does not believe in chronic tetanus. In subacute tetanus there is no fever and the symptoms are attenuated. The picture is only one of degree. In these cases the incubation runs from 8 to 30 days, the course is milder, and the mortality is around 40 per cent. We must always remember that the characteristic symptom of tetanus of whatever sort is muscular hypertonicity accompanied by great pain.

The retention of foreign bodies containing in themselves, or in their vicinity, locked up in scar tissue, the spores of tetanus may be the cause of a fulminating tetanus after some late operative procedure which disturbs that part.

Local tetanus is most difficult of diagnosis and is confined, as a rule, to segments of the central nervous system. This is the form which has called out a remarkably acute clinical sense among surgeons of this war. It is similar to a form of tetanus produced experimentally in animals by the local injection of small doses of toxin, not sufficient to kill, into muscle in animals, resulting in a spasm of this muscle only. If a larger dose is used the curious fact

is observed that the muscle of the corresponding side is affected; and if a still larger one is used other muscles on both sides are involved. In other words, it is a question of dose, and this phenomena happens in man and accounts for some of the queer aberrant forms referred to as being so difficult of diagnosis. In fact, local tetanus can be said to be similar to the experimental form, but at any time infection may flare up in man and entrain the generalized form. It is not a very uncommon condition, but such forms are very apt to come on two or three months after the injury. The mortality is about 40 per cent. Among the queer forms seen in this war we must mention what was known in old surgeries as "traumatic surgical spasm." This is the local tetanus we are describing. The treatment is preventive. For instance, to illustrate a case of localized delayed tetanus: This man had two of the three shrapnel bullets in his left thigh removed. For two weeks he had great pain, the slightest movement of the foot would bring a spasm of certain muscles of the thigh. In localized tetanus, even after a man is apparently cured, very weak electric currents give an excessive muscular reaction in the muscles previously involved. The treatment of tetanus is 8 to 10 gm. of chloral by the mouth or rectum per day, and in case the focus has not been rid of the bacilli entirely he recommends subcutaneous or intravenous injections of antitoxin rather than intraspinal, because the object is to get the antitoxin into the circulation, which it will enter but slowly from the spinal canal.

There are two forms of tetanus seen commonly in this war: First, local tetanus, confined to the nuclei of the motor nerve of the part affected only. There is never any trismus or general rigidity or convulsions. At times bulbar phenomena appear, but these are really acute localized conditions. This is the form called by the old authors, in their ignorance, "traumatic surgical spasm." Second, retarded localized conditions after a secondary operation is done for the removal of foreign body.

It is not necessary to isolate cases of tetanus because the proven cases of infection from man to man are very rare. One should institute early physiotherapy to avoid contractures. Above all, please remember that there is no real danger to be apprehended from anaphylaxis.

Army Sanitary School No. 68.

RIFLE SPLINT

By Captain Cowell

I. *Preparations*.—Five narrow, folded triangular bandages; two broad, folded triangular bandages. Remove the bolt of the magazine.

II. *Placing of splint*.—Butt up, magazine pointing in the opposite direction from the operator. Lay a bandage across the butt, two-thirds hanging down on the right if for the right leg; take a turn around the butt with the long fold.

Tie a butt loop.

Place the rifle, with its magazine up and muzzle projecting below the sole of the foot. Take another triangular bandage, cross it behind the ankle, bring the long end between the rifle and the malleolus, first passing over the rifle, then encircle the muzzle at the point of the sight.

Then cross the short ends, pass over the dorsum, under the instep, and tie over the dorsum.

Next, pass a bandage under the buttock and crotch, and pass the outer strip through the butt loop, from below upward; upper slip from below downward.

Pull taut and tie.

This pulls the body and upper fragment one way and the thigh and lower fragment the other, producing extension and counterextension.

Then put a bandage around the head of the tibia. Now apply the Goch splints, as in the Thomas drill; place a bandage around the ankle, then one around the waist to bind the butt to the hip; then tie the legs together.

Army Sanitary School No. 70.

SURGICAL VARIETIES AND TREATMENT OF GAS GANGRENE

By M. lé Medecin-Major Piollet

SUMMARY

Gas gangrene is an infection caused by anaerobic germs, its initial localization being in the muscle, where it produces rapid mortification of the injured tissue, causing gases and having a tendency to spread, largely producing grave and often fatal poisoning.

The present war has shown its frequency.

Bacteriology.—Anaerobic bacilli: *Vibrio septicus* of Pasteur, *B. sporogoncs*, *B. bellemensis* of Saquepée, *B. oedematiens* of Weinberg, *B. perfringens* (*aerogenes capsulatus* of Welch (of Veillon)). These bacilli are alone or associated with streptococci and aerobes. Real gas gangrene is a general infection. Localized gangrenous infections must be studied separately.

Clinical varieties.—Ordinary variety: Diffuse gas gangrene. Starts locally by production of gas in the wound. General condition is quickly impaired. Evolution is fatal in from 24 to 35 hours.

Very acute variety: Malignant edema (traumatic erysipelas). Starts a day or two after the wounds and before incision. White swelling of the limb, no gas. Poisoning general and overwhelming. Death occurs in a few hours. Grayish green edema (bronze colored erysipelas). Starts a few days after the wound. Grayish green swelling with small bubbles of gas under the skin and blisters. Poisoning general and rapid. Death occurs in from 12 to 24 hours.

Subacute variety: Gas phlegmon. Infection of the wound which takes a brown dry aspect, producing gas all round. It spreads progressively but slowly and is curable by immediate surgical treatment.

In opposition to these varieties must be placed the localized gangrenous infections without a tendency to spread: Gas abscess; gas mortification.

Varities and their chief localization: Gas gangrene is a disease of the muscle. Occurs most frequently in the lower extremities (78 per cent), in particular the buttock, the thigh, the calf of the leg.

These infections are not, strictly speaking, specific.

One germ corresponds to each clinical form of varying gravity, according to the nature of the aerobic germ associated with them. Their association with saprophytic germs causes a mild form with staphylococcus a severe form, and with streptococcus a form of excessive gravity.

The *perfringens* (bacillus of Welch) alone produces a mild form.

Treatment.—Treatment by serotherapy: Has not yet given definite results. The following sera are prepared: Antivibrio septicus, antibellonensis, antioedematiens, antiperfringens, serum of Bull.

(NOTE BY COMMANDANT.—See remarks on Bull's serum.)

Surgical treatment: Prevention very important. Immediate incision and excision of mortified muscle, extraction of metal, objects, and clothing.

Treatment curative: Can not be successful unless applied immediately, before the poisoning of the subject.

Very acute variety: No treatment can cure it. Even amputation is useless.

Acute and subacute variety: Large incision of the skin and the aponeurosis. Very large excision of the injured muscles.

Medical treatment: Local—useless or harmful (injections of hydrogen peroxide or of oxygen). General—warmth; intravenous injections of alkaline solutions; general treatment of the infected parts.

Conclusion.—Infection is of such extreme gravity that it must be diagnosed at the beginning under pain of certain death to the wound.

SURGICAL VARIETIES AND TREATMENT OF GAS GANGRENE

By M. le Medecin-Major Piolet

In 1914 all wounds were badly infected and gas gangrene was common and very fatal.

The cause of putrid infection is the anaerobic variety of microorganisms, but these are much more potent when combined with aerobes.

The affected part is swollen and is generally brown in color; it gives rise to crepitation in handling and is sonorous by percussion (nail fillip or "chicotage"), one of the earliest signs.

A radiograph will also disclose gas areas in time to give a very precocious diagnosis. The skin is often marked by dusky lines. On incision there is not much bleeding; in fact, it is characteristic that the muscle is bloodless due to the shutting off of circulation by the pressure of gas developed under muscular planes. This in itself devitalizes the tissue and causes the spread of infection. The tremendous pressure to which the muscles are subjected is evidenced by the herniating of this muscle on incision. Both the ischemia and the preliminary action of pathogenic aerobes (staphylococcus and streptococcus) kill the muscles and deprive the tissue of oxygen, giving a favorable medium for the anaerobic bacteria. Another peculiarity of invaded muscle is that it has lost its normal color and power of contracting to a stimulus. Moreover, fine gas bubbles escape from amongst the fibers. The tissue is greenish or gray. There is no line of demarkation in gas gangrene, as in certain muscles, single or in groups, the invasion runs high, while other muscles at the same level but not in the same sheath are quite untouched. It always tends to spread longitudinally and this spread is typically rapid. As ischemia invites invasion, the lecturer emphasizes the necessity for preventing any constriction of vessels.

CLINICALLY

Diffuse gas gangrene is extremely fatal. The facies are leaden and the picture of that of shock. There is a septic intoxication, which may be enhanced by a true concomitant streptococcal septicemia. The pulse is rapid; there is dyspnea and a subicteric tint. There are no subjective symptoms; often a condition of euthanasia. Loss of consciousness is not characteristic. The extremities are cold and death occurs in 24 to 48 hours. If amputation is performed in time the patient may, however, recover. Notwithstanding its serious nature, gas gangrene may be self-limited.

Gas gangrene may not develop for from two to five days, but these late infections are not necessarily benign. The infection is heralded by the wound becoming dry. This is an important sign; it finally develops an odor, there is swelling of the part, and "bronzed erysipelas," the name given the peculiar discoloration of the skin, comes on. These retarded cases give a dry wound with a mousy odor, there is swelling and consequent constriction from the bandage, and thus a subacute or chronic form is initiated.

MALIGNANT EDEMA

In some cases there is no crepitation and the muscle, although greenish brown, contains no visible gas. This form is very serious and the patient may die in 12 hours. There is a white swelling of the limb which extends high up. The condition is that of an overwhelming massive intoxication.

BRONZED ERYSIPELAS

This is a variety marked by the color of the skin as per its name. There is a tendency to ecchymoses and blisters around the edge of the wound. Here also gas may not be in evidence and death occurs in from 12 to 24 hours.

Both malignant edema and bronzed erysipelas are very rapidly fatal forms.

Professor Piolet states that the principle of treatment is to follow up all affected muscles to the point where normal muscle appears. He states that there are now comparatively few surgeons who insist that the injection of oxygen under the skin will arrest gas gangrene and that it is an old and broken-down theory.

The subacute varieties, which are in general slower, are still quite rapid in producing their evil effects. In fact, all forms are found from local gangrenous wounds to general gas gangrene.

GAS PHLEGMON

This develops in from 24 to 36 hours. The wound has a disagreeable, ratlike odor and gas accompanies the serum which escapes. There is a slight temperature and a cavity in the green or brown muscles. If incision is prompt and sufficiently extensive up to normal muscle the progress of this form can be arrested, but it should be remembered that such incision should include the edematous parts beyond the actual gangrene. Many times a large muscle may be only affected in a portion of its mass and yet give a tense covering fascia as if it were all attacked. In such a case, if the limitation of the process can be made out, it is enough to remove only the damaged part.

Gas abscess and localized gangrenous dissolution of tissue are not really cases of gas gangrene, although they are caused by anaerobes. The treatment is free incision and Carrel-Dakin.

In his experience one-fifth of his cases were of the malignant edema type, one-fifth bronzed erysipelas, and three-fifths of localized forms. Seventy-eight per cent of such cases were of the lower extremities, the buttock, thigh, and calf of the leg, in order named. It was usually associated with fractures.

M. Piolet spoke strongly against the indiscriminate use of tourniquets.

He said that while one can not find a clinical type of gas gangrene for each type of anaerobes producing the disease, his impression was that the *Vibrio septique* was most common in serious cases and the *perfringens* in the localized forms. The most deadly cases are those in which the streptococcus is associated.

Too much emphasis can not be laid on the necessity for immediate intervention when gangrene is limited to a segment.

Dissect out all the muscles affected. Where amputation is decided upon, go as high as possible and do not close the stump.

Gas gangrene does not ordinarily affect the tissues of the head.

Army Sanitary School No. 73.

VISIT TO AMBULANCE 3/66

May 12, 1918

At 12 o'clock the parties of both groups who visited the trenches in the morning met at this field ambulance for medical cases, in a beautiful little town, which was very ancient and in a very historic portion of France. It was in a château on a height, the entire hill belonging to the château and being parked. Here we took dinner with the officers and were shown over the place later. The hospital proper is in barracks, neat and very restful, from the beautiful views and fine walks in every direction. It was chiefly used for sick and skin cases, but it did not present any special features save that it was remarkably well administered. Gassed cases were brought to the gas quarter by a separate entrance. They sprayed lightly gassed clothing with an alkaline solution, beat it, and hung it out for about two days. Heavily impregnated clothing is sent to the sterilizer. All of the division gas cases come through here. We were told that liquid paraffin is an excellent thing to use for mustard gas in the eyes, and, also, we were given the following prescription for a powder for skin burns, due to the same cause:

Talcum.....	200
Sodium bicarbonate.....	100
Zinc oxide.....	100

The ambulance was a divisional one and had a capacity of 300.

In anticipation of complications which must frequently arise in the nose and throat, a laryngologist was on duty there, and he used 10 per cent gomenol in oil as a spray for the throat and nose in addition to putting several drops in oil inside the cavity in cases of mustard-gas poisoning.

We noticed in visiting their general ward for sick that they had a small epidemic of what looked like influenza going on.

In addition to the sick and gassed there were separate wards for skin cases with separate douches.

THE SALIENT POINTS IN LECTURE BY MAJOR COLLIN, AT HIS FIELD AMBULANCE, MAY 12

It is necessary for front-line surgeons to know the roads and trenches well, and part of the instruction of the enlisted men of the detachment should be insistent upon this point. The work of the litter bearers is a severe test of endurance. At Douamont we had 1,500 yards to carry and each litter squad covered it six times in 24 hours, which means 21 km. at 3 hours 40 minutes per trip, under fire and over a most difficult road. Of 25 litter bearers available on paper, 20 only can be counted upon because 5 will be sick or on leave. Of these 20 men, 12, or 4 per company, must be destined for the battalion, which consists of 3 companies; 2 teams, or 8 men, should be left the medical officer at his battalion station. You should keep these men yourself, and don't let the regimental surgeon have them, nor the commanding officer. When you are in unorganized sectors do not tell off the men to companies but keep the men near you so that you can dispatch them as they are needed in critical moments. In that way you always have them in hand.

The litter bearers of the G. B. D. should carry from the regimental aid station back. If a regimental medical officer needs help to get men back from his battalion aid station, he should get it from the G. B. C. (*groupe brancardiers du corps*). It should be a policy of the corps surgeon to keep these organizations well up to the front in an attack so that they can get to the regimental aid station to reinforce them in time to be of use. He mentioned a situation where he once sent for G. B. C. men at ———, but he didn't get them until 24 hours afterwards, when the real crisis was over. The place of a regimental medical officer during combat is at his station. This is no time for him to assume heroic attitudes or satisfy his personal romanticism, as the men will be thus left without a doctor at the place they are told to go and find one. The regimental medical officer's duties are not only medical and surgical but paramedical and parasurgical. He means by this that the regimental medical officer can start a man right medically and surgically so that when he gets farther back he will automatically receive the best and the most scientific attention. He also means that his paramedical duties are to study the psychology of the men, anticipate their wants and their needs, and provide for those things which, although not strictly medical, prevent disease and a breaking down of morale. The regimental medical officers should see that men are always as comfortable as possible, and this should be his first thought. If we provide for them light, warmth, and food we have gone a long way in this direction. The surgery that he does can be summed up in the words: Clean up and stop hemorrhage. Treat shock, and evacuate as soon as possible. He says that antitetanic serum should always be given at the battalion aid station and that it is rare that it can not be done if it is made the business of the surgeon to do it. He likes porch curtaining for splints for small bones like those of the forearm and leg. His treatment of shock is rather primitive, because he seems to depend a great deal on stimulation by camphorated oil in large doses. He says the best place to treat shock is at the R. A. P. He lays, however, a great deal of stress on the heating of patients. He is not convinced that advanced surgical posts are feasible. If they are used at all they ought to be put at the side of the ambulance head, but, as he says here, the worst is then over and the short distance back to a decent hospital is easily covered without much more damage to the patient. The answer to the whole thing is that when a regimental aid station, or even a battalion one, is far from the ambulance head or very far from the H. O. E., or both, the proper thing to do is to prepare it properly for the maximum of surgical work. He believes in good surgical equipment at regimental aid posts because they are often cut off by barrages, and you must have some place to do surgery.

A gas attack means a sudden overwhelming of the battalion aid station if order and discipline are not maintained. What happens is that everybody falls in at once in great confusion and in a great deal of excitement. If the cases are mustard-gas cases, after proper change of clothing, etc., they are easily evacuated, often sitting or even walking, if only lightly gassed. But it is absolutely forbidden to evacuate a chlorine gassed man save in the recumbent position. They are a very serious problem when there are very many of them, as there usually are. If there are only a few you can treat them yourself, because first aid here

is most important. You have to be ready to do a tracheotomy at this place. He lays great stress on the thoroughness of gas discipline and gas prevention which has an educational effect on the rest of the command. If your gas preparation is good, they imitate you.

The disposition of the G. B. D.—The best way is to have advance posts in echelon. They are usually commanded by an auxiliary medical officer or a pharmacist. They send out squads who are in immediate contact with regimental aid stations. In the latter case it is well to make your G. B. D. men mess with your R. A. P. and sleep with them if possible. It makes them think they are all a part of the station and it prevents arguments as to who is to carry the patient back. At every thousand yards there should be a relay of one noncommissioned officer and 4 to 6 men. One of these G. B. D. posts should be at the ambulance head. These dressing stations should be of large capacity, because men are held up there very frequently awaiting transportation on account of condition of roads, shelling by day, blocking, barrage, etc. Great preparations should be made to feed men and give them hot drinks and a place for them to lie down. There should be preparation for emergency treatment and dressing room to replace bloody dressings, etc., but no dressing should be interfered with at this station unless some definite reason for changing it or adjusting it appears. You may use poussettes or bruettes (wheeled litters) in transferring patients from this station to the field ambulance, and you may even use them between the regimental aid station and this station, especially on paths at night. The narrow-gauge railroad, 40 cm. wide, can be utilized either forward or in the rear.

The triage at the field ambulance.—We must have faith in the regimental surgeon and be guided by his diagnosis in making triage. The triage ought to be liberally interpreted in a crisis, such as battle, and the regimental medical officer ought to be able to direct where the patient is to go and send him there by the shortest route. At the field ambulance hemorrhage can be stopped, shock can be treated, and grave cases can be operated upon.

The personnel of the medical department for a regiment having three battalions.—Each battalion comprises a technical personnel and a mobile personnel:

Technical personnel—

- 1 medical officer.
- 1 auxiliary medical officer.
- 1 corporal (dresser).
- 3 enlisted men (dressers).

Mobile personnel—

- 1 corporal (litter bearer).
- 1 cyclist.
- 25 litter bearers.

Total for a regiment:

Technical personnel—

- 6 medical officers.
- 3 corporals (dressers).
- 9 enlisted men (dressers).

Mobile personnel—

- 3 corporals (litter bearers).
- 3 cyclists.
- 75 litter bearers.

Regimental medical staff—

- 1 major.
- 1 pharmacist (officer).
- 1 sergeant (litter bearer).
- 1 corporal (clerk).
- 1 cyclist.

Disposition of personnel of a regiment in an organized sector prepared for combat.—The battalion of the first line:

Technical personnel—

- 1 medical officer.
- 1 auxiliary medical officer.
- 1 corporal (dresser).

Mobile personnel—

- 1 corporal (litter bearer).
- 1 cyclist.
- 8 litter bearers.

The rest are distributed to the companies.

Battalion, second line: Same, except that he has 4 litter bearers in place of 8.

Regimental aid station:

Technical personnel—

- 1 major (chief of the service).
- 1 pharmacist (officer).
- 1 corporal (clerk).

Mobile personnel—

- 1 sergeant (litter bearer).
- 1 cyclist.
- 4 litter bearers.

He refers to the elephant iron of the dugout as “abri metro” and states that it should always be below ground if possible and have a bursting layer above it. He refers to the cap for trench frame as the “chapeau” and to the upright as the “montant.”

Groupe de Brancardiers Divisionnaires.—Medical personnel:

- 1 major (chief of the service).
- 1 medical officer, assistant.
- 1 pharmacist, officer, chief of the laboratory of toxicology.
- 1 assistant medical officer, auxiliary.
- 4 auxiliary pharmacists.
- 6 petty officers.
- 12 corporals.
- 106 litter bearers, of which one is a cyclist.

The battalion aid station ought to be big enough for 16 lying and 30 sitting, with food, medicine, and other matériel, prepared to take care of patients for 30 hours without resupply.

The regimental station ought to be larger and must be ready to take care of patients for 48 hours. The regimental station should have room for 90, 30 of them recumbent. The Hospital Corps men should be taught to dig dugouts. When you go to organize a sector, organize from the rear battalion aid station or regimental aid station forward, because if you begin in front you may be working for the boches.

Army Sanitary School No. 74.

GENERAL CONSIDERATIONS OF THE WOUNDS OF WAR

By M. le Medecin-Major LECENE

SUMMARY

(Translation)

The wounds produced by missiles (bullets, shrapnel, shell splinters, bomb fragments) are in the most cases primarily infected and, besides, the best conditions are realized in these wounds for the culture of bacteria.

The causes of severity of infection in cases of shell and gunshot wounds are mainly two:

First. The presence in the tissues of foreign bodies, viz, the missiles and, above all, pieces of clothing or equipment; these latter fragments are always grossly soiled by the anaerobic bacteria of the earth.

Second. The crushing, tearing, and shattering of the tissues (especially of muscles, involving rupture of their blood vessels) prepares a perfect culture medium for contaminating bacteria; hence, the frequency of septic complications in the nontreated gunshot wounds (tetanus, gaseous phlegmons, cellulitis, etc.). Therefore, the best treatment of gunshot wounds is to hinder, to prevent the development of the infectious process in the wound.

During the first 24 hours which follow the injury, experience has demonstrated that it is possible to prevent infections:

1. By dissecting anatomically the track of the missile.
2. By removing the severely bruised and torn part of the tissues.
3. By removing the missile and the pieces of clothing and equipment introduced with the missile.
4. By accomplishing a careful hemostasis.
5. By accurately suturing the clean surgical wound so created (with a safety drainage of one or two days).

When applicable, this method of treatment of gunshot wounds is undoubtedly the most certain of giving the best results.

But when, for various reasons, the wound can not be treated within a sufficiently short time after the injury, it must be treated as a septic wound; that is to say, freely incised; cleaned; freed of the missile, foreign bodies, and dead tissues; and left open, or, at the very least, well drained. It is often possible in cases so treated to make a secondary suture of the wound.

Generally, if the dead and devitalized tissue, foreign bodies, etc., are removed within 24 hours, infection is prevented. When wounds can not be handled with a view to primary suture, or the primary delayed suture, the wound can be treated as a septic one by the Carrel-Dakin method. As a matter of fact, infection can be prevented or attenuated by removal of this dead and devitalized tissue up to 72 hours, but there is no certainty of a good result with such delay. A gentle stream of water to wash out the ground up material and foreign bodies is useful in cleaning the wound. Lecene considered that 80 per cent of wounds are due to shrapnel, shell, and grenade fragments, and 15 per cent to rifle bullets. He emphasizes particularly the difference between shrapnel, which produces the old lesions of bullets in the Civil War, inflicted by projectiles of low velocity, bruising and lacerating the tissue immediately surrounding the tract, and the sharp, cutting edges of the irregular pieces of shell blown in at high velocity, which cause molecular death at a distance from the tract and cut as well as lacerate and bruise, frequently nipping pieces out of arteries and veins and half sectioning nerves. In the case of vessels, the hemorrhage may be controlled temporarily by a little clot, which gradually gives way, forming a traumatic aneurism. However, if this little clot breaks down soon enough a secondary hemorrhage occurs. Partial section of nerves in this war is very common. In the Balkan war evacuation from the front was slow, and there was no teamwork between surgeons at the front and the rear. The result was that the wounded that got to the rear alive were usually those wounded by bullets and the wounds had sealed aseptically; hence the conclusion that bullet wounds were not serious; but in reality what happened was that it was merely a survival of the fittest, as many of those who were wounded by ricochet bullets, shrapnel, and high explosives either did not arrive at all or were considered to be shrapnel wounds only when they did. As a matter of fact, in the Balkan war nothing special was said of artillery wounds.

Rifle bullets at short ranges, 300 to 500 meters, cause an explosive effect. The explosion of a shell may be near enough to produce shock, which may be fatal without producing a wound. Most of the fragments of a shell removed from a patient are small ones. The reason for that is that the large pieces kill the man outright. At 50 yards pieces of shell act like rifle bullets at short ranges; that is, with explosive effect. The hand grenade is feared more than the shell because in addition to the injury which it produces there is the shock, as most of those grenades explode near the soldier. Lecene has seen as many as 200 wounds produced by the explosion of a hand grenade.

One of the great differences between military and civil surgery is that in military surgery we get large numbers of wounded at once, under conditions where it is difficult to have enough surgeons and enough material.

All of these high-velocity projectiles, bullets and pieces of shell, hitting at short distances, destroy the bone by perforating two-thirds of the distance and blowing out the last third, the fragments of bone acting as secondary projectiles. Thus it can be seen that the surgery of war has changed just as have the instruments of destruction made to produce wounds. The speaker did not believe that the wounded should be held at a field hospital

or ambulance head for operation or sorting, but that they should be sent directly to the nearest surgical hospital for proper treatment; nor does he believe in antiseptics if aseptic surgery can be done, because antiseptics devitalize tissue.

There are a certain number of wounds which do not lend themselves to primary suture, or even the excision of all devitalized tissue, as such an operation would take too long and produce too much shock, and might sacrifice an unjustifiable amount of such tissue. In such cases the Carrel-Dakin solution should be used after removal of foreign bodies and as much dead tissue as possible. The first-aid package is of use only in preventing additional infection (especially to reduce the danger of implanting streptococcus from infected fingers). The slightest wounds occurring in the trenches may mean infection and should be cared for even if they are nothing but scratches. An interesting phenomenon is the deep infection of wounds by the *Bacillus cutis communis*, which is caused by the blowing in of a section of skin in front of the projectile. Some slight amount of injury to the tissues may occur from burning by hot projectiles.

Ricochet bullets or bullets purposely reversed by the enemy before firing in passing through the soft parts have the effect of destroying in their path only the amount sufficient to let them through, but the edges are burned and there is molecular shock of the flesh surrounding the tract. When a ball strikes an object before hitting the body it explodes and causes what we call a "hernia" of the lead, causing it to look like a mushroom. This has a very destructive effect. It is known as a "dum-dum" bullet when produced artificially. The same effect can be produced by turning a bullet backward before firing (reversed bullet). The characteristic fracture produced by such a bullet is the butterfly fracture with long fissures that may run to the joint.

He mentions that in cold weather a great deal of heavy clothing is carried in if the projectile is irregular, but that a rifle ball will slip through it without carrying in much, if any. Shell wounds can be compared to a certain extent with the kind of wounds that we see in railway accidents. They are very large and very dangerous, chiefly on account of their irregular cutting edges as above described. Incomplete fractures are very common in this war. The burst of a hand grenade generally wounds up to about 40 yards.

Army Sanitary School No. 75.

THE FLAVINE ANTISEPTIC IN THE TREATMENT OF INFECTED WOUNDS

Paper read by Lieutenant Valdes, Lieutenant Colonel Keller's Hospital, January 11, 1918

Undoubtedly, the introduction in therapeutics of the Carrel-Dakin treatment produced in 1915 a revolution in modern surgery, decreasing to a considerable extent the percentage of mortality among wounded soldiers. Due to the marvelous results obtained with the Carrel-Dakin method, other antiseptics were brought under investigation, for use in the treatment of infected wounds, and one of these is the product known as "flavine."

In January, 1917, Browning, Gulbrandsen, Kennaway, and Thornton, in England, made a careful and detailed study of the bactericidal properties of acridine dyes, and several compounds belonging to this group were brought under observation with a view to determining their suitability for therapeutic use in infected wounds. Among the substances investigated was the compound "flavine," now called "acriflavine," prepared by Benda for Ehrlich, and originally named "trypaflavine," on account of its therapeutic action in trypanosome infections. There are two varieties of the flavine compound: "Acriflavine," which is diamino-methyl-acridinium chloride, and "proflavine," which is diamino acridine sulphate or chloride, and "proflavine," which is diamino acridine sulphate or chloride. Proflavine is a preliminary product in the manufacture of acriflavine and therefore cheaper. According to laboratory investigations, these substances should yield practically equal results in the treatment of infected wounds, and, therefore, they are always referred to as flavine. Observations, however, have indicated a point of difference between these two compounds which is of clinical interest, viz, that proflavine exerts a degree of hemostatic action. In view of the attention which has recently been directed to the employment of "flavine" compounds

in the treatment of infected wounds, Lieut. Col. W. L. Keller encouraged me to make a concise description of these antiseptics in order that those of you who intend to employ them clinically may have more fully at disposal the indications for their use.

It was found that while in the case of all the diamino-acridine compounds tested the antiseptic effect was enhanced by the presence of serum, especially for *B. coli*, diamino-methylacridinium chloride (acriflavine) and diamino-acridine sulphate (proflavine) exerted the least degree of inhibitory effect on phagocytosis. Browning, Gulbransen, and Thornton extended their investigations by studying the effect of prolonged contact of a solution of antiseptic in serum on the phagocytic power of leucocytes, when subsequently staphylococci were added. The mixtures of one volume each of "leucocyte cream," serum, and antiseptic solution were incubated in capillary tubes at 37° C. for two hours. The control contained saline instead of antiseptic. At the end of this time, one volume of staphylococcus suspension was added, and after thorough mixing the whole was again incubated for 20 minutes in order to permit the phagocytosis to occur. It was then examined under the microscope and it was found that a 1:10,000 solution of the flavine antiseptics, after two hours' contact with the leucocytes at 37° C., had little effect on the phagocytic power, whereas this concentration of mercuric chloride reduced the phagocytic count to below 50 per cent of the control. In doing these investigations, they bore in mind that, so far as bactericidal action is concerned, 1:10,000 represents the limiting concentration of mercuric chloride, any further dilution of which with serum abolishes antiseptic action; on the other hand, such highly bactericidal concentrations of the flavine antiseptics after prolonged contact, leave the leucocytes still capable of phagocytic action.

PROPERTIES DESIRABLE IN A THERAPEUTIC ANTISEPTIC

The most advantageous properties of an antiseptic depend almost entirely on the particular purpose for which it is used. Thus, the sterilization of material outside the human body, as in disinfecting garments, instruments, etc., is a matter entirely different from the sterilization of a wound; in the former practically the sole necessity is to destroy the organisms, but in the latter the properties of the antiseptic must be so adjusted as to insure efficient action on the bacteria, but producing the minimum of tissue destruction, and without interfering with those protective and proliferative functions upon which healing depends. Thus, it is far preferable to succeed in inhibiting organisms in a wound, at the same time avoiding damage to tissues, or diminution in their resistance, than to aim at obtaining bacterial sterility by means of reagents which produce necrosis and throw out of action protective mechanisms such as phagocytosis.

Therapeutic application.—The sterilizing action of flavine compounds has been compared to that of mercuric chloride and phenol. It was found that it progresses gradually, thus after two hours' contact in the presence of serum mercuric chloride is equal to acriflavine in its lethal effect on staphylococcus and *B. coli*. But by this time the effective action of the mercury salt on the bacteria has come to an end, and a concentration which has then failed to kill the organisms exerts subsequently little or no inhibitory effect on the proliferation of the survivors. On the other hand, concentrations of the flavines which at this period have merely inhibited multiplication, later on prove bactericidal, so that finally the flavine compound is ten to twenty times more lethal than corrosive sublimate.

It has been shown clinically that when the flavine compounds are used for therapeutic purposes in the treatment or prevention of septic infection in wounds, the tissues are not harmed by the concentration of the antiseptic, and the admixture with the serous secretions of the wound enhances the sterilizing effect instead of bringing it to an end. The fact that the maximum antiseptic effect of flavine is obtained in a serous medium is of extreme importance and should be kept in mind to avoid too frequent flushing of the wounds. Unsatisfactory results have been obtained following the two-hourly irrigations as in the Carrel treatment.

The application of flavine is as follows: The "open" wound with assured free drainage is swabbed out once or twice a day with swabs soaked in flavine (1:1,000), care being taken to reach into all the crevices of the wound, and also to remove sloughs. The wound is then lightly packed with gauze saturated in the antiseptic, and the whole covered with dry gauze.

Once the infection has been practically overcome, weaker solutions may be subsequently employed, for instance, 1:5,000, with advantage, or else the application of flavine may be intermitted for a day every few days, dry dressing being substituted in the intervals. Should it be desired to adopt the method of introducing flavine compounds into wounds by means of tubes, as in the Carrel-Dakin treatment, instead of packing with gauze soaked in the solution, it should be remembered that only small amounts of fluid should be introduced, the frequency of the irrigations not exceeding 3 or 4 in 24 hours. However, in the cases we employed flavine here we observed that it gives the best results in local dressings.

About 24 hours after the flavine dressing is applied, the surface of the wound is of a bright yellow color, especially where fascial or tendinous structures are exposed. Pus, if present, soon diminishes in quantity. This remains the characteristic condition of the wound for from two to three weeks. Then the yellow surface, mainly due to the deposition of a tough layer of plastic lymph, gradually disappears, being replaced by small granulations of a pale pinkish color. In some cases, this change takes place much more rapidly, giving good small dark red granulations. In the course of the third week, generally the epithelium starts growing.

THERAPEUTIC VALUE OF FLAVINE COMPOUNDS COMPARED TO THE CARREL-DAKIN TREATMENT

Not long ago Captains Bashford, Hartley, and Morrisson, of the R. A. M. C., made a careful study of 50 cases treated by flavine, comparing their result with that obtained from other 50 cases treated by the Carrel-Dakin method. They used both the aeriflavine and proflavine, and the results were substantially the same. The primary object of their work being to confirm the good results claimed by the earliest workers with flavine, they made it a point to adhere as closely as possible to the lines of treatment laid down by them. The wounds as a whole were not of great gravity, a fact which they had in consideration in estimating the value of the treatment. Almost all had been treated previously at the front by the Carrel-Dakin method within 24 hours of being wounded, and, in the majority of cases, very efficiently. The patients reached their wards at periods varying from one to six days from the date of reception of the wound, and the flavine treatment was then substituted for that of Carrel-Dakin. For comparison, a similar table of results obtained by the Carrel-Dakin treatment was made, dealing with as nearly parallel a series of 50 patients as possible. The only material difference was that the Carrel-Dakin series was made up of much more seriously wounded men. It included all the severe cases regarded as unsuitable for the flavine series on account of the experimental nature of that treatment.

They kept a close watch on the flora of the wound surface in order to practice a secondary suture at the earliest possible moment. It is a curious thing to mention that in the wounds treated by the Carrel-Dakin method, the streptococci were usually the last organisms to disappear from the infected wound surface. In the cases treated by flavine, however, the commonest type of organism to outlive others in the wound surface was a Gram-negative bacillus.

They made several charts showing graphically the comparative rapidity with which wounds treated by the Carrel-Dakin method and flavine, respectively, became ready for secondary closure by suture. It was demonstrated that from the tenth day on till the eighteenth, the number of flavine cases bacteriologically clean varies from one-third to one-half of the number of cases similarly clean under the Carrel-Dakin treatment. The temperature reached normal distinctly earlier, as a rule, in the flavine group, but the percentage of failures to reach the normal line while under treatment with flavine was rather greater. Under the influence of flavine, only 38 per cent of the cases attained the standard required for suture. This is in marked contrast to the 68 per cent under treatment in the Carrel-Dakin series. The authors sustain the superiority of the latter, considering the number of wounds sutured (54 per cent as opposed to 34 per cent) and the percentage of patients evacuated to England healed (56 per cent, as opposed to 22 per cent); that is more than two and one-half times as many.

Flavine, however, is an important antiseptic in the treatment of abdominal wounds, as it has been demonstrated that besides being highly bactericidal, it is absolutely innocuous if injected inside the peritoneum. In fact, some English surgeons highly recommend it in the treatment of intestinal wounds.

We have had the opportunity of observing that in wounds which have been kept for a long time under the Carrel-Dakin treatment and in which the continuation of the Dakin's solution shows no further improvement, the immediate change of antiseptic and the employment of flavine soon produces nice red granulations and a rapid healing.

Army Sanitary School No. 76.

VISIT TO AMBULANCE No. ———, MAY 12

This is a field hospital for nontransportable and is one of the two field ambulances under Major Okinezye, consulting surgeon of the Army, who has devoted himself in this war chiefly to abdominal surgery. He has been operating as near the front as possible on non-transportable cases, and he is one of the chief exponents of the theory that an advance surgical hospital should be pushed well forward to operate on serious visceral injuries which would be harmed by further transportation. His hospital used to be 3 km. behind the lines, but he was shelled unmercifully and had to fall back to a distance of 12 km. from the lines. At present he gets his patients six hours after they are hit.

The ambulance is immobilized in a small barrack hospital, which was Lemaitre's and where he did his first work on the primitive suture. Lemaitre described to me personally how, when he exhibited his first 30 cases to the inspector general of the Medical Department that gentlemen, after listening silently and observing the results, told him that it was marking a new era in military surgery, but inasmuch as there were strict orders against sewing up any wound at that time in the French Army, he should proceed in a manner to avoid unjust criticism. He did, not however, order him to stop. Lemaitre says that this little hospital was far easier to work out a good line of cases than a big hospital would have been. He had a group of very loyal assistants and a fine administrative officer. They lived there like a community of monks until the results of this remarkable work had to be made public. The hospital is so small compared with the big H. O. E.'s that we have seen that it looks like a little toy village. Everything is miniature, everything is complete, and everything absolutely clean. It has recently been spoiled by the fact that they have built around it cantonments for troops and a big supply dump. Moreover, it is near the town, only a few meters, which, because it is pretty and neat and quaint, will probably receive attention from the boches. In anticipation of this, the huts are all well protected by revetted, splinter-proof breastworks, and there is an underground splinter-proof dugout in case of bombardment, which would not, however, protect against direct hits. The personnel for this hospital is as follows: 5 medical officers, 1 radiologist, 1 pharmacist, 1 administrative officer, 42 men, and 15 drivers.

Three sectors supply this hospital with patients. Recently the two army corps field ambulances are used—one for surgery and one for medicine.

There was no feature of bathing, operating, radiology, laboratory, etc., that was left untouched. The plan of the hospital in general is that it is built around a rectangle, the wards and operating rooms leading off at right angles to a covered cement porch running all round the wall, so that everything is compact and right in the hollow of the hand, as it were. In the center of the court a Bessonneau tent had been erected for the reception of the patients, and the floor of this tent was sanded. There was a reception room for disrobing and taking of histories, and beyond this a bath, also a heating room with the usual litter trestles and hoods, tables for washing up the patient, combating shock, giving transfusion, etc. In this room the hood differed somewhat from that we had previously seen. There was a battery of electric lights below the litter and one above the patient, within the hood, so that he lay between lights, underneath and above. In this room the operating surgeon saw his cases and made his selections. At the end of the rectangle were the operating rooms, offices, pathologist and bacteriologist, radiologist, sterilizing room, etc. Electric light was furnished by the group complementaire. There were two operating rooms and the hospital accommodated 400 patients. The slightly wounded in this hospital were used for donors for the transfusion of blood. During periods of inactivity there are two operating groups at this hospital and they alternate for duty—one on one day and the other on the next. Near the operating room there is a shock room separate from the rest, which is a hot room. The sterilizing room

lies between the operating rooms and divides both. We saw a few cases here. A wound of the axilla in which the axillary artery had been successfully tied and the median nerve repaired by primary suture. Unfortunately, it was not observed at the time, owing to the hurry and bad condition of the patient, that the musculospiral and the ulna nerve were also cut. The result is that at this late date, after the operation, the median nerve suture has been entirely successful and has almost recovered its function, but there is a paralysis of the muscles served by the other two nerves with what looks to be a hopeless contracture. The lesson to be drawn is that the primary suture of nerves is eminently successful, but that more careful work should be done to examine, at the time of operation, the condition of these nerves.

Case 2.—Fracture of the tibia.

Case 3.—An eviscerating shell wound of the abdomen with primary suture. This man was in desperate condition when operated upon and owing to the necessary incompleteness of the operation has still a jejunal fistula. The surgeon says he will close this fistula under cocaine very soon.

In reality ——— is a small evacuation hospital of the first echelon and a very good example of the type. The place was exquisitely clean, attractive, cheery. Major Okinezye took us in to the Bessonneau tent, which was empty, where he provided chairs and a table and gave us a talk on what he considered the proper treatment of the nontransportable should be. He said the idea of the advance surgical hospital was an excellent one, and he intimated that this hospital should be a field ambulance. He defined the nontransportable as those patients who could not be further moved without endangering their lives or seriously aggravating their condition, and mentioned the following classes of cases which might properly fall into the category of patients for such formation:

First. Those suffering from or in danger of hemorrhage, requiring ligature or transfusion, or both. None of these cases should ever leave a field hospital with a tourniquet on. This should be an axiom.

Second. All chest and abdominal injuries. The most important are the chest because they will surely die, especially when they are open, unless primarily treated. Their sufferings are great and they are generally in terror of death. Not less serious are the wounds of the abdomen, but the suffering is not great at first, and in many cases they do not appear to be in very bad condition. These should be operated on immediately for obvious reasons. Brain cases should be sent on, as they bear transportation well.

Third. Compound fractures of the thigh. They should always be rested here and at least have their splints examined and adjusted, if necessary. As a matter of fact they very frequently require shock treatment, but if they are in very bad shape with much damage to soft parts and to vessels they had best be kept.

Fourth. All cases of shock should be rested here until their condition improves at least.

From the above limitations as to patients to be held at this hospital it will be seen that only the very bad or the moribund cases are stopped, so you must have no roseate hopes for fine statistics. You ought to be mighty happy if you get 70 per cent of recoveries; that is to say, if 70 per cent of your patients live. It is believed that under such conditions the surgeon should be brought to the man and not the man to the surgeon. Besides, intransportable cases are nonevacuable anyhow, and they will need to be stopped at the evacuation hospital. Unfortunately, in times of activity these hospitals can not be depended on, as their accommodations are always small, and for other reasons most surgeons must be held at the main operating center. It is very difficult to turn a regimental hospital into an advance surgical station, as the demands upon them are very great. A good example of this is that in periods of activity they frequently haven't even time for men to give the antitetanic serum. Under such conditions a new advance surgical hospital would relieve the regimental aid station of a large amount of work and responsibility, as the most you can get done at a regimental aid station is to check hemorrhage and amputate a dangling limb. He adverted, however, to the fact that the scheme of advance surgical hospitals on a systematic scale would probably fall down in a push. His idea of an advance surgical hospital is that there should be three in each army corps and one for a division, and all must be underground. They had best be 40 feet long and the usual 2 m. wide, with three entrances, and on one side of a main corridor (which should be used for the waiting patients and their preparation), six alcoves. One for an X-ray room, one for an operating room, and the rest for wards. The whole thing can

hold 15 or 20 patients. Each of these hospitals should possess its own electric lighting apparatus, generated on the spot. The average distance from the line should be 5 to 7 km. There should be three per army corps and one for a division.

Army Sanitary School No. 77.

LOCALIZATION OF FOREIGN BODIES IN WAR TIMES—METHODS COMMONLY USED IN THE SANITARY STATIONS AT THE FRONT

Summary of a lecture by Dr. Th. Nogier professeur agrégé de physique medicale, à la faculté de Lyon

The X-ray tube.—Details of its structure. Its important parts, the focus or emitting source. X rays are produced within one hemisphere of the tube only.

The normal ray.—Among all the X rays in the tube, one is of quite special importance, and is called the normal ray; i. e., the ray perpendicular to the fluorescent screen. The position is determined by means of a normal ray finder, in French a "centreur." The normal ray passing through the axis of the "centreur" also passes through the center of a diaphragm or stop in front of the tube. If such a diaphragm is very narrowly opened, only a very thin pencil (i. e., practically the normal ray itself) will come through and will be easily traced out on the fluorescent screen.

Methods of localization such as are used in sanitary stations at the front may be referred to as radioscopic, magnetic, or electric processes.

A. RADIOSCOPIC PROCESSES

We consider, in succession, simple methods, complex methods, and anatomical methods.

(1) *Simple methods.*—Turning limb or body of wounded, which leads up to two following principles: (a) If image of projectile travels in same sense as that in which the limb does, the projectile is to be found between screen and axis of revolution of limb. (b) If image of projectile travels in opposite sense, the projectile is to be found between focus and axis of revolution of limb.

Impressed motion of projectile: The touch-handle or "palpeur" of Nogier allows easy finding of parts where such motion is most intense, and consequently easy determination of shortest distance between projectile and skin of wounded.

Use of two parallel rays: Two rays, both normal and parallel, the one passing through projectile, the other grazing tangentially surface of skin, render the exact measurement of distance between skin and projectile quite easy.

(2) *Complete methods.*—We shall study successively those which may be used in light cases, and those which must be resorted to for severe cases.

(a) Double axis method suitable for application in light cases: Use of two perpendicular axes or rays passing through projectile. How marks may be printed on skin at points of emergence or entrance of the normal ray (lead ball, metallic ring). Use of Nogier's "pince radioscopique" for simultaneous finding and printing on skin of above-mentioned points. Debierne's graph, showing true position of projectile within limb of wounded.

(b) Double axis and double image method suitable for application in severe cases: The "knife" process. Principle: The image of two metallic bodies that are equally distant from screen undergo equal displacements for given displacement of the X-ray tube. Use of Hirtz-Gallot's screen. Principle: Replace the real projectile by a virtual projectile whose image will undergo some displacement as that of real projectile, for one and same displacement of tube. Double image by displacing tube. The distance between screen and projectile is given by:

$$X = H \frac{l}{L + l}$$

where H is distance between focus (anticathode) and screen, L displacement of tube, l distance between two images on screen. Graphical construction of Haret and Jaugeas. Use of ready reckoners (Baremes).

(3) *Anatomical methods.* (a) Front view and side view. (b) Use of "troneonnages"; the numerical dates arrived at in above process are referred to as "coupe anatomique." (c) Noticing movements of projectile. Such movements, v. g. muscular contraction, breathing in and out, systole, etc., may give indications as to seat of projectile.

B. MAGNETIC OR ELECTRICAL PROCESSES

(1) *Compass.*—Its needle deviated by magnetic projectiles.

(2) *Bergonie's electro-vibreux.*—The magnetic projectile is made to vibrate within tissue under influence of electric magnet which is excited by alternating current. One may feel with hand parts where such vibration is maximal.

(3) *Hughes four-induction balance.*—Four small inductive coils in perfect equilibrium with regard to magnetic conditions. Presence of metallic foreign body destroys such equilibrium, and causes sound to be heard in telephonic receiver. (Apparatus: La Baume Pluvinel's "doigtier audioscopique.")

Army Sanitary School No. 79.

INJURIES AND WOUNDS OF THE EYE

By Major Magitot

The frequency of wounds of the eye can be estimated at 5 per cent of the total number of wounds.

For the facility of description it is expedient to consider three groups: (a) Laceration of the eyeball—the eye is destroyed; (b) wounds of the posterior hemisphere; (c) wounds of the anterior hemisphere.

(a) *Laceration of the eyeball.*—Only fragments of the organ remain. Line of conduct may be summarized thus: Wash with serum 12 per 1,000; remove the fragments, preserving the conjunctival flaps; restore the eyelids. Evacuate the patient as soon as possible to an ophthalmic center.

(b) *Wounds of the posterior hemisphere.*—The fragments of the shell reaches the deep segment of the eyeball by passing through the temporal region or along one of the walls of the orbit. Clinical symptoms are: More or less marked exophthalmia, chemosis, hemorrhage in the anterior chamber; loss of vision; dilated, motionless pupil. Line of conduct: Wash with saline and suture the eyelids to protect the eyeball and prevent corneal ulcer. Evacuate if possible.

(c) *Wounds of the anterior hemisphere.*—These are the most important ones. The vulnerating agent may touch the cornea alone, or the ciliary region alone, or both simultaneously. The extent of the wound is likewise an important factor, for a small wound may close up in a few hours. One can consider three kinds of wounds of the anterior segment:

1. Wounds respecting the shape of the eyeball: The first question to solve is presence or absence of a foreign body in the eyeball. Place the patient in a dark room and examine him with a pocket electric lamp held laterally. Pay attention to the following signs: Discoloration of the pupil; pupil more dilated than on the other side; turbid aspect of the aqueous humor. Examine in the field of the pupil; cataract.

One must always look for the point of entrance of the foreign body and see if there is no corresponding wound in the iris (in the shape of a little black hole). Skiagram necessary. In doubt admit the presence of a foreign body, for toleration is exceptional. Wash the eye with 12 per 1,000 saline and send the patient to an ophthalmic center, for extraction with an electromagnet. Never use atrophine.

2. Wounds causing collapse of the anterior segment: More or less large lacerations with hernia of the iris or ciliary body. In these cases it is extremely important to begin by installation of a few drops of novocaine; then wash with 12 per 1,000 salt solution. The treatment of these cases consists in excision of the hernia and covering the wound with a conjunctival flap.

Enucleation is never an imperative operation, and it is better for the wounded to have it performed by a specialist. If the patient be untransportable, and it is deemed indispensable to enucleate, the essential thing is to preserve the conjunctiva, or the eye socket could not hold a glass eye. Once the eye is removed never insert a drain or gauze in the wound.

Sympathetic ophthalmia is very grave, but happily not frequent. In the whole course of the war French ophthalmologists have only seen 30 cases. It can be avoided by asepsis and sending the patients to an ophthalmic center promptly.

There is a twofold aim to be attained: (1) Preserve the remaining vision. (2) If vision is irretrievably lost, preserve a normal appearance so that the patient will not consider himself like a mutilated man and enable him in many cases to continue his former profession.

Laceration of the eyeball; remove fragments of the eye and bone splinters. Repair the eyelids. Drain the injured facial cavities.

Wounds of the posterior segment.—Signs: Loss of vision; chemosis; lowered tonus of the eyeball; blood in the anterior chamber; motionless pupil; sometimes exophthalmia.

Treatment: Expectant; if exophthalmia, suture eyelids; slightly compressive dressing covering both eyes.

Wounds of the anterior segment.—(a) The shape of the eyeball is preserved: Wash with saline solution; excision of the hernia of the iris; removal of foreign body with electromagnet; cover the wound with the conjunctiva; binocular dressing.

(b) The eyeball is collapsed: Wash with saline solution; amputate the anterior segment or its remnants.

(c) Infection: Signs—chemosis and pain; slight temperature. Remove the eyeball.

Army Sanitary School No. 81.

VISIT TO FRACTURE HOSPITAL AT ———

This was about 20 kms. from ———, northwest, and was 25 kms. from the firing line. It had accommodations for 400 patients, and was a beautiful old château. The hospital proper was chiefly of huts, on a height, overlooking a rolling country, well wooded, filled with flowers, and near a picturesque little town. It is one of the most attractive spots I have seen in this very beautiful country. The connecting covered passageways and all outside construction was of the rustic style. It was clean and neat, well furnished and supplied, and everybody seemed comfortable and happy there. It was much too far from the front line and the surgeons stated that nearly all of their cases were already infected when received.

We went first to the surgical group and saw the triage. This room was equipped with trestles upon which were placed hooded litters for five patients, to each one of which was led off a lateral rubber tube connected with a central supply pipe, 2 inches in diameter and 30 feet long, which furnished hot air for shocked patients. The entire five could be heated with two alcohol lamps from one central point. In addition there was a large stove in one corner of the room for hot drinks and a place for heating sandbags, bottles, etc. The triage is connected by covered ways with the hospital wards.

In the extensive park in which this hospital was accommodated, with its walks shaded by tall trees and lined by flowers, was an open-air amphitheater fitted with easy chairs, for those patients who were convalescing from old infections. The surgeons seemed to think that this sunning played an active part in their recuperation, which evidently took the place of the Carrel-Dakin solution, and which he did not believe in apparently—at least he did not use it to any extent. The following cases were shown:

Case 1.—Wounded November 27, 1917. Received 13 hours after injury. Primary resection of left elbow and left knee. The resection of left elbow was followed by primitive suture, and this joint was immobilized three weeks before movement was attempted. It was halfway between pronation and supination and half extended. He did not mention what result he had gotten from the knee. The elbow, of course, was ankylosed to a large extent.

Case 2.—Severe comminuted fracture of the humerus near the head. He removed the head of the bone and all the pieces for 3 inches. Has a flail joint as a result, but he will do a myoplasty later on to help to remedy conditions.

Case 3.—A compound, comminuted, subtrochanteric fracture of the femur in an aviator due to a phosphorus shell which caused phosphorus gangrene. Later on this man had secondary hemorrhage from the femoral artery near the profunda. He was transfused with blood and the artery was tied, but there was no gangrene of the lower extremity. This man was wounded on the 20th of March. He was primitively sutured, but dangerous infection

resulted and the flat sterilized dressing which was being used was rapidly substituted by Carrel-Dakin solution. Then the temperature fell rapidly.

Case 4.—Shell wound, middle third of left thigh, with fracture of the femur and considerable destruction of bone. He was wounded the 26th of September, 1917. Was plated three months after being wounded, although he had streptococcus at the time. The plate was removed after three months. Carrel solution was never used in this case, and in the operation many bone fragments were removed before plating.

Case 5.—Fracture of the patella. Civilian. States he expects to cure in a month, as it is a simple fracture.

Case 6.—Subepiphyseal bullet wound of left humerus. As it was punctiform, it was simply immobilized with a Delbet apparatus and an aseptic dressing put on it.

Case 7.—Compound fracture of the femur due to accident. This had streptococcus and *prefringens* infection, and primary plating. The result was not determined.

Case 8.—Primary resection of the knee and removal of splinters from the humerus.

Case 9.—Shell wound of right femur, September 26, 1917; 8 inches shortening. There was streptococcus infection and septicemia, but despite this the plate was put on and kept on two months. Immobilization was produced by freshening the tibia and setting the lower end of the tibia upon it. Drained for two months and plated in spite of the streptococcus. Leg was about 8 inches short and the man was still on his back. The union was not bony, but fibrous.

Case 10.—Phlegmon of the pelvis resulting from osteomyelitis of the ilium with secondary hemorrhage from internal iliac artery, necessitating 500 gm. of blood transfusion.

Case 11.—Shell wound of the upper humerus, right, March 18, 1918. Upper third of the humerus destroyed and the scapula badly splintered. The result is not determined.

Case 12.—Shell wound of the left arm, with fracture of the humerus and severing of the musculospiral nerve. Carrel-Dakin is used in this case. Also shell wound of the left knee—treated by resection.

Case 13.—Shell wound of the upper third of the left femur. Loose fragments removed.

In a lecture and demonstration of this hospital by Doctor Latarget he expressed his opinion that bone plating was not done enough. He says he doesn't resect joints unless half or more of the joint is destroyed, but nevertheless he showed one head of a humerus and one femur that was absolutely without any injury whatsoever which he had resected for a diaphysis beneath it. He showed us in connection with his bone plating a very handsome dental rotary burr and an apparatus for applying screws and plates. He also demonstrated a large number of X-ray plates to illustrate results obtained in bones and joints he had resected. In general he goes by all of Leriche's most extreme views, but he "out-Herods Herod." He states that they make their own splints in this hospital. The operating statistics he gives are roughly, as follows: Out of 553 fractures, 281 were of the upper extremities with 3 deaths; 136 of the lower extremity, with 20 deaths; 130 cases were multiple fractures, with 52 deaths.

These should not be sent very far to the rear of the battle field for operation, as they die of shock. Fifty-five of his complicated fractures showed injury to large vessels. Of these, 6 of the upper extremity and 8 of the lower were operated on on account of gangrene. He had 15 deaths from gas gangrene. Of 12 transfusions of blood in the shock room, 7 recovered.

In the evening on returning, the commandant asked Major Baer to speak of his treatment of joint wounds. In substance he stated:

REMARKS OF MAJOR BAER

Wounds of the knee joint require primary excision of devitalized tissue and removal of the foreign body. The joint should be washed out with ether, chloroform, or normal salt solution, but you should not use the Carrel-Dakin solution because it will produce ankylosis. Then the capsule should be sewn up and a primary delayed suture done for the muscles and skin as soon as the bacteriologist reports that it is safe. The knee should be moved within 6 to 12 hours and voluntarily by the patient—never passively, and the man should be gotten out on the knee in 10 days.

If the joint fills up with fluid so that it can not be moved, it should be aspirated. If a portion of the condyle is loose, it should be removed, but never resect a knee if one condyle is left.

Major Baer explained how the standard treatment in surgery was being recommended by the interallied congress. He states that any new subject or new treatment that is proposed is gone over by a committee, opened for discussion and acted upon, and that in general the above is what the interallied congress had decided was the proper thing to do in joint injuries. He states that for infected joints the treatment of Wilhelms was now creating much comment, as the results seemed very good. This treatment consists in crucial lateral incisions over the joint and one flushing out with Dakin's solution. Then a large, loose dressing is placed on it and the patient is encouraged to walk. This squeezes out the pus and increases the synovial fluid, which acts as a continuous bath from within outward, irrigating the joint. The results he quoted were very remarkable and seemingly better than any so far obtained by any other method.

Bone plating is not considered applicable to any save the following bones in war surgery.

Subtrochanteric fractures, supracondylar fractures running into the joint, and fractures of bones running into the elbow joint. While here admissible, it must be remembered that bone plates compress the periosteum which they overlies and cause necrosis of the same and are not well tolerated. Its importance, however, is not yet decided and bone plating is being again used a good deal in a tentative sort of way. It is hoped that it will give better results under improved technique and especially with the primitive suture to help it out. Bone grafting is not considered applicable in war surgery, as wherever it can be used it must be used a long time after the wound is healed—a year or more.

Army Sanitary School No. 82.

VISIT TO H. O. E. 32, MAY 8, 1918

This beautiful hospital is the best evacuation hospital that we have yet seen in any of the armies and one of the best administered. It was situated at the foot of an abrupt hill, from which it gets its water, which is said to be abundant and of good quality.

The hospital receives its patients from the right wing of the army, and the nearest point in the firing line is 15 km. away. Patients are received directly from the regimental aid stations, G. B. D. posts, advanced surgical hospitals, and field ambulances. Its capacity is 3,350 patients, but, like all of these hospitals, it can be expanded, in this case to 5,000. There are several distinctive features about this hospital which made it exceedingly agreeable to visit. In the first place there was no trash lying about, and everything was put in its place; second, the grounds were ornate and many flowers were seen; third, the huts and barracks were well painted and in good repair, and tents were well pitched and new; and, fourth, the discipline of the place was excellent and men were not lying about in slouchy uniforms. Any man able to be about rendered the customary salute.

The water is stored for distribution in a central group of tanks raised on a high platform. There were four of these tanks and they are used in pairs. The water is Javelized. They are filled by gravity from the mountain and pipes leading out from them supply the various buildings, also by gravity. This hospital has no shell-proof cellars or dug-outs, but the huts are revetted for about 3 feet against the scattering of bomb fragments. The roads are good, of macadam, and are well guttered. Supplies are delivered over the grounds by a narrow-gauge railroad. Patients are received by motor vehicles, and evacuated from the hospital by hospital trains. A double spur runs up to a long curved platform, which allows the patients to be loaded without difficulty into two trains at once. This, of course, is immediately beside the evacuation wards.

The hospital was burned and built up again about five months ago. It is near its twin hospital, and lies toward ———. The first portion of this hospital visited was the operating group. There are three receiving wards. The two on the end are used for the reception of patients requiring operation. They are deprived of their clothing and cleaned in two rooms, where there are two tables for that purpose, but in these rooms the wound itself is not touched. They are then placed in bed in wards. From there they pass on to the center barrack into the preoperating room. If, when they reach here, or even before it, they are in a state of shock they are sent into an adjoining room for shocked patients, where there are four beds with the feet raised. This room is very simple and is heated to 35° and kept that way all

the time. It is practically a hot-air bath, but in case patients still need more heat there are the electric-lighted hoods, described in other papers for rechauffement. The surgeon divides his cases of shock into those of nervous shock, who receive saline infusions, and hemorrhagic shock, in whom the transfusion of blood by Jeanbreau's method is practiced, provision being made for both in this room. In the preoperating room the patient is prepared for operation, and when he is prepared he is carried by the litter bearers who are on duty through the corridor to the waiting ward for cases to be operated on. From this ward he passes by the corridor when called for operation to one of the radiograph rooms, where radioecopy or radiography is done. If some one is being radiographed when he arrives, a small waiting room next to this one is provided for him. This being completed, the patient is moved into one of the operating rooms. There are two operating tables in each one of these rooms, and they are very simple and well lighted, but not at all large. No instruments were kept here at all, but were all kept in the sterilizing room, which was the distributing depot for instruments and dressings, furnishing two sets of three operating rooms each on either side and which connected directly with the autoclave truck sterilizer belonging to the auto chir, which was stationed outside the building and communicated with this room directly. As the sterilizing of gloves, instruments, and dressings is done in the central plant, this sterilizer was only used in time of emergency to reinforce the central plant and to attend to pressing emergencies. One of the three operating rooms on either side was set apart for septic cases. Just beyond this group a covered way led to a group of administrative buildings of this operative group—the names on the plan indicate the purpose for which they were employed. One of the end rooms was used for the laboratory. This laboratory was very simple. In fact it was only a field mobile laboratory, and everything in the room could be packed in six small chests which form the regulation laboratory equipment of the French Army, but the quality of the work here was most excellent. The bacteriologist on duty took cultures always before operation and also at the first dressing, as well as thereafter up to as many times as he was required to take them. In the first sowing of cultures one tube was inoculated for aerobes; it was a simple agar slant. Another was melted in the form already described by Doctor McGrou—the Veillon agar for anaerobes, and a third, the Vignal capillary glass tube was filled with a more diluted culture of the same Veillon agar to enable the bacteriologist to get isolated colonies of anaerobes. At the same time a careful count was taken from smears in cases where such numerical counts ought to be made to make up the bacteriological curve, which was kept much as a fever chart would be kept. The bacteriologist here, however, gave much more importance to the presence of streptococcus and in general to the qualitative culture than he did to the number of bacteria. The bacteriologist stated that he watches the staphylococcus pretty carefully, especially when it is combined with another organism, but when the streptococcus appears he always advises keeping the wound open. In a case treated by the Carrel method he noted that the microbes were reduced from 20 in a field to 1 in 4 fields within 4 days. This operative group filled 880 beds, referred to as the beds kept for hospitalization.

We visited from here some of these wards and they were clean and exceedingly well administered, the surgeon in charge of this group being an unusually liberal-minded and bright young man. A few fractures had been sent there by accident (as the hospital does not usually receive fracture cases) and they were put in suspension with Balkan frames; but it was evident that in spite of the fact that he believed in closing joints primarily, he was afraid to mobilize them under 10 days and kept them immobilized up to that time in plaster with iron supports. He did state, however, that he believed in early mobilization and considered that 10 days preliminary immobilization was the least that one could do to put it into practice. It was in this hospital, however, that for the first time I saw a liberal comprehension of the discoveries of modern military surgery relative to the treatment of wounds. This surgeon apparently had no prejudice, nor was his enthusiasm for one or the other method so violent as to prohibit his using one or the other as they seemed best. For instance, in one case a man had multiple wounds. The smaller wounds were primarily sutured in one thigh, but in the leg of the same side there was also a large wound which was prepared for primary delayed suture; a third, in the buttock, was already receiving Carrel-Dakin solution. There was also evident a complete coordination between the bacteriologist, the surgeon, and the radiologist. In another case there was a gunshot wound of the knee and ankle from a grenade attack, with

profuse hemorrhage, requiring Jeanbreau's transfusion of blood. The capsule of the joint was closed by primary suture and some days later the muscles and skin were closed when the bacteriological examination was satisfactory, but the ankle was being treated with Carrel-Dakin solution. When cultures are taken in a Carrel-Dakin case, the solution is suspended two hours before they are made.

There are 20 operating tables that can be used for fresh wounds in this hospital.

From the surgical wards we passed by the pharmacy to the central sterilizing plant. This plant was not as complete as the one at ———, but was very clean and neat and the pharmacist in charge had a very clear idea of administration. Some very neat-looking French nurses were making dressings. The difference was that in this place not only the dressings but the instruments and gloves were sterilized and that they were sterilized in the same box. The contents were covered with a piece of gauze upon which was sprinkled 200 cg. of formal powder, and this went into the autoclave and was kept at 80° of steam for 45 minutes. It seems to me as though there would be a serious change in the chemical composition of formal when exposed to steam which might damage the instruments. The pharmacist states that he dries all instruments by a vacuum of 45 mm. They were very well satisfied with the central sterilization system, which they said gave infinitely better results than the old one. It was far more economical of men and fuel, prevented confusion in the operating groups, and never broke down. All dressings, instruments, etc., had their own particular sort of metal box, and the cotton and gauze was sterilized in larger ones, generally biscuit tins.

All gas cases go directly to the quarter for the gassed without going through the triage. As will be seen this has a capacity of about 550. There was a separate receiving tent for asphyxiated and vesicated patients, as the treatment was totally different. Asphyxiated cases were more liberally supplied with oxygen, and were lying patients. They were admitted as rapidly as possible, put to bed immediately, and given oxygen and other treatment described in the appendix. The treatment of the vesicated, of which there have been a great many cases recently, differed from all other we have seen in that they were attended to first and inscribed last. This gas reservation was the most perfect that we have ever seen. It was scrupulously clean and ideally arranged for large groups of men. Preparation for an influx of many patients was more necessary in this part of the hospital than in any other, because when there is a gas attack patients come in large numbers, all at once and all need to be treated as soon as possible. They were admitted into a long barrack with cement floor. First, they were disrobed, the clothing being thrown out through a flap door into the open. Then they rapidly passed into another room for bathing. The water was alkalized and an alkaline soap was furnished them; there were 16 showers provided. From this room they were passed into another containing alkaline solutions and sprays for eye, nose, throat, etc. The nose was irrigated by the familiar glass nasal nozzle attached to a rubber tube fitted to a white enamel irrigator and the fluid was admitted at low pressure, but it did not seem to me to be very safe for an excited man owing to the danger of the fluid being forced into the eustachian tubes. We heard here that the gomenol, 10 per cent in oil, spray was used for the nose and throat after the alkaline gargle. There was, however, no steam closet for the respiration of alkaline vapors, which would have been a fine addition. In the next room the patients were dried and given clean clothing. In this room provision was made for treating shock, and patients who had become exhausted could lie down. Next was a large rest room in which was a bureau for the taking of the man's history, booking him and inscribing him in the proper form. On the side for the asphyxiated cases there was a barrack building fitted up with 40 enameled iron beds, along one eave of which, behind the beds, was a long pipe with a distributing branch at the head of each bed for attaching a rubber tube ending in a rubber funnel for the administration of oxygen from one tank to 20 men at a time. It was a rather crude way of giving oxygen, and the Haldane apparatus seen with the English, supplied to groups of 4, seemed much better.

We now saw the radiologic outfit—not the one which belongs to the auto chir and which is installed in the operating group—but the one for the entire hospital for more formal and deliberate radiologic examination. This was not comparable to the one at ———, but was good and efficient.

We now saw the section devoted to disinfection and the salvage of dressings. This was in a hut. There were several large tubs filled with water or solutions. The gauze is treated as follows: It is soaked 24 hours in cold water; then 24 hours in another tub filled with chloride of lime solution, 1 to 1,000; then 24 hours in water again; then it is boiled, then laundered and folded, and, finally, sterilized in a steam sterilizer at 134°. The cotton was picked and only the apparently unsolded portions were saved. These were packed and shipped to the salvage depot, the dirty portions being burned. At another portion of the barrack was a concrete floor with a place for washing stretchers with hose and brush. They were kept wet with water for some time to get out the blood stains. At a distance from this plant was a circular closed incinerator of brick, 12 feet in diameter and 8 feet high, with two grates, one above the other, the lower one being 18 inches from the ground, and a high smoke-stack. To reach this incinerator, a narrow-gauge track had been extended, with cars like coal cars, which ran round the top of the incinerator and dump directly into it. It was the nearest approach to the British incinerator that we have seen, but it was pretty expensive in fuel, and the object for which it was constructed—the concealing of smoke from the enemy—was not attained, as the smoke was not destroyed. It did not burn anything but the camp waste.

We now saw an advance medical supply depot for advance troops which carried a six months' supply of dressings and medicine and 20,000 gas masks.

In passing by we noticed the quarters for nurses and for officers of the hospital. The officers lived in small huts, mostly of pasteboard, and their kitchens were separate for each "popette."

The garden, we were told, yields 25,000 francs a year. We saw in the center of the reservation, fenced in by barbed wire, a Bessonneau tent and operating group, especially for prisoners of war. The Bessonneau tent was partitioned off, by canvas painted white, into separate rooms for officers, noncommissioned officers, and enlisted men. The floor was sanded and it was in the pink of condition, clean and wholesome. Everything that the French soldier had was furnished them—every medical and surgical comfort as far as I could see. The latrines were of the usual squatting type, but an attempt had been made at some rude sort of sanitation. The latrine consisted of a canary-colored building open on one side, built upon a cement base, with 10 or 15 places to squat. The feces fell into a gutter in the cement which discharged through a pipe, emptying into a deep cesspool, which was turfed over. The gutters were filled with cresol solution, which seemed rather strong, and the dropping of the feces into this solution must have caused some rather painful burns. We were told that once a day they pulled out the plug and let the accumulation of 24 hours flow into the cesspool. That is to say, everything that floated went and everything that got stranded stayed. None of these latrines are fly proof.

The kitchens were exceedingly clean and the food they were preparing was certainly appetizing—good fried potatoes, nice vegetables, good meat; everything was perfectly orderly and clean. The floor was of cement. This kitchen cooked for 800 hospitalized patients, and the ward orderlies came up in white caps and aprons for the full amount of food consumed in their ward. This kitchen had eight cooks. At this place was also a cooking school, I understand.

The recreation hall was furnished by the Red Cross. It was very pretty and clean and well decorated. It had a scheme for darkening the windows at night which was interesting. It was simply tar paper roofing tacked on frames which were suspended on small rods or wires, and could all be lowered at once.

An apparatus for distilling water was seen near one of the big boilers; the exhaust of the steam pouring out of a 2-inch pipe was chilled by an inside pipe containing flowing cold water, an inch in diameter; this cold water circulating in the inner pipe caused condensation of the steam, and the distilled water was collected in a large vessel.

THE SECTION FOR EVACUATION

This also was the best that we have ever seen in any army. There was a large Bessonneau reception tent to which were directed all the slightly wounded, and in time of a push these were defined as all those able to walk, in whom there is no wound of a large joint nor

fracture of the thigh, leg, humerus, or skull, nor any wound involving any of the "splanchnic organs." As a matter of fact the most of these are able to walk and they are brought into this large Bessonneau tent. This floor was sanded and the whole interior absolutely clean, woodwork and all, and completely ready to functionate at a moment's notice. On entering they passed to the left and were made to sit down. From here they were called and passed to be bathed in the sections facing them. They then entered the dressing room where they were given clean clothing and from that compartment were sent to the refreshment section where they received hot drinks and food. Then their "particulars" are taken at the office which is at the center of the tent. They were then directed to sit on the benches on the other side of the tent. Six litter trestles are kept for patients that are not able to sit up any longer. If, however, any one of these men suddenly needs an operation he is taken immediately across to the two operating compartments for emergencies and operated upon on one of the four tables. If the crowd is not too great, as many of these men as possible, or only the more seriously wounded ones, in a great rush, are passed through a corridor into an operating group for the slightly wounded next door. Eighty such patients can be operated on in 24 hours per table. It is noticeable that this operating group is complete, as it has its radiologic and bacteriologic departments and wards in buildings near by. It is also noticeable that the wards connected with the evacuation plant are fitted up with iron beds in the place of trestles. All of them are clean and only in those wards next to the station which housed the outgoing, a train load, did we find the trestles supporting litters. It was explained that this was done because long delay on a litter is hard for a wounded man and these patients have to stay sometimes 48 hours or more awaiting a train. While they are here they are made comfortable in beds and are not kept on litters. They are promptly transferred to the litter supports when they are ready for evacuation, a short time before the train arrives. There is also a large Bessonneau tent for the sitting cases. This entire evacuation department was especially clean and neat and ready for instant use. It was the most poignant object lesson we have seen of preparedness for large crowds of slightly wounded at an evacuation hospital. Barracks were being prepared for the reception of the wounded of an English corps who had a semi-independent existence under the general supervision of the commanding officer of this hospital. The French took great pride in making this English quarter as perfect as possible. It was all freshly painted; it was stacked full of all sorts of supplies; and it had an operating group for the hospitalization of patients of this H. O. E.

Near this large evacuation department is the train shed which runs along the whole east front of the hospital; patients are carried out here on the litters and prepared for entraining. Two trains can be loaded at the same time here. Ordinarily, there are two trains a day in a push. During this push 120 medical officers are required for the hospital at ——— but only 40 during quiet periods.

We now visited a large Bessonneau tent near the track which served to store a reserve mobile evacuation hospital of 400 beds for the advance echelon of H. O. E.'s. It is said that there are four of these hospitals kept always ready to move in each army. It consists of 4 Bessonneau hangars and 32 Bessonneau tents, No. 2. This store hangar was completely filled with the matériel for this hospital, and it was being prepared to move out the next day. It was absolutely complete—dressings, instruments, even down to a fire extinguisher; nothing was missing, and when it was set up it could functionate completely. Its personnel was 200; 100 were here to ship it and the other 100 had been sent ahead to receive it and set it up. It needed for transportation thirty 10-ton railway cars, or 100 motor trucks, and the time required to transport it 15 kms. and set it up was 8 days, but, naturally, the hospital could be functioning in one or two days with the setting up of the first elements that arrive. This is the nearest approach I have seen in the French or British Armies toward a mobilized evacuation hospital, and anyone who has seen the Bessonneau tents can realize what an extremely practicable thing it is.

The last place visited was the group of specialists' centers. There were three huts; one occupied by the dentist, one by ophthalmologists, and one by the otorhinolaryngologists. The ophthalmologist was running a dispensary and fitted glasses except for astigmatic cases. Even the latter can be furnished if the patient remains in the hospital a sufficient length of time, as he has a lens grinder here. He has a little operating room and a special X-ray outfit

next to it, but he states that this is not an operating center for the eye and his operating outfit is only for such cases as he might have in the course of his practice. He has, of course, hospital accommodations for his patients. The otorhinolaryngologist was very well equipped with instruments, operating room, dressings, etc. The dentist showed us, with considerable pride, a portable stomatological outfit in a truck and a dentist chair, donated by American dentists. There was a prosthesis room which seemed to be complete for the making of bridges. Two sets of teeth could be turned out a day.

The pharmacy of this group was very well equipped and had a large number of trusses.

NOTES ON THIS HOSPITAL FURNISHED BY ITS COMMANDING OFFICER

This H. O. E. is in the third sanitary echelon of the army, the first being of divisional formations, the second of corps. That is to say, this is one of the largest and most important of the evacuation hospitals of the French Army. The French have recently adopted the plan of having three lines, or echelons, of H. O. E.'s or their equivalent, one behind the other.

It retains for hospitalization:

- I. In the quarter for hospitalization—
 - (a) The intransportable.
 - (b) Those who may be returned to the front in four or five weeks.
- II. In the quarter for evacuation—
 - (a) Evacuable wounded or sick who will probably not be fit for duty at the front within four or five weeks, whether operated upon or not.
- III. In the quarter for the treatment of gas—
 - (a) Patients suffering from suffocating gases.
 - (b) Those suffering from yperite.
- IV. In the dispensary quarter for the army—
 - (a) The slightly sick, indisposed (*écloppés*), and those requiring dental treatment.
- V. In the quarter for prisoners of war, for boches; it evacuates the *écloppés*—
 - (a) To the zone of the army.
 - (b) To the zone of the interior, to nearby or distant units, the evacuable wounded and sick.

According to the results of military operations, in provision for an attack, for example, where it is ordered that a maximum number of beds be held in reserve, the duration of convalescence can be lowered to 15 days, or even increased, the condition of the hospitals being the same as in the better hospitals in the interior which permit a prolonged stay.

This H. O. E. is well situated on an elevated plateau, which permits the rapid drainage of surface water, and yet is protected from the north and west winds by the chain of hills near by. It is reached easily by a number of roads.

It is large and occupies an area of 25 hectares, is connected by a double-track line with ——— and Paris, the station of the main trunk being 500 m. away, and it is not in proximity to supply depots and ammunition dumps. It presents, therefore, relative security against aerial bombardment. Black crosses 30 m. from tip to tip and 5 m. broad are visible to any aviators at more than 3,000 m. A conduit from a spring on the near-by hill fills the cement reservoirs, each of which have a capacity of 20 c. m. They distribute water to all operating wards and to the different quarters.

The entrance of the H. O. E. is marked by large signs which are visible a long distance by day, and by lights during the night, in addition to which there is a police post with an orderly at the entrance and others between it and the triage. Aside from the wounded that arrive in motor ambulances, some arrive on foot and must be directed rapidly toward the reception wards of the triage. For the reception of a great number of wounded at one time it is necessary to provide large receiving stations, "reservoirs for the reception of patients," well lighted, provided with benches for the sitting and with trestles or litter supports for the recumbent, with a station for hot drinks, and at the same time a reservoir of hot water, with installation connected therewith for washing patients. Lastly, there is provision made for the heating of shocked patients. Nothing is more distressing than to see the roads encumbered with motor ambulances full of wounded and without a place to go for comfort and cover. Prevent blocking.

DISTRIBUTION OF THE DIFFERENT SERVICES IN AN H. O. E.

Groups of operating buildings are needed for the preparation of the wounded so as to leave to the surgeon the exclusive mission of operating. It is necessary to operate quickly and well before evacuating.

1. Wards for hospitalization.
2. Wards for evacuation in which the wounded man is to be lodged only temporarily; tents may be utilized and are easily set up.
3. General administrative offices, storehouses, workshops, etc.
4. Quarters for officers, for female nurses, and for enlisted men of the Medical Department.

Pharmacy, surgical sterilization plant, laundry, tea house, chapel, and morgue.

All technical administrative and working parties are divided into teams in order to carry on their services continuously, as follows: First team on duty from 9 p. m. to 5 a. m.; second team on duty from 5 a. m. to 1 p. m.; third team on duty from 1 p. m. to 9 p. m.

In times of inactivity only one triage is needed for the hospital, but in times of activity the triage is divided into triage for sitting and triage for lying patients, the two being separated a sufficient distance to avoid disorder and confusion. In case of a grand rush of patients, hangars can be utilized which will contain 200 lying or 500 sitting. The vesicated cases are directed immediately to their special gas stations so as not to contaminate the reception wards ordinarily destined for other patients.

THE OUTPUT OF THE HOSPITAL

The number of beds is 3,380, and these are designated as follows:

	Beds
For hospitalization, 22 wards, 40 beds each	880
For evacuation lying, 20 wards, 40 beds each	800
For evacuation sitting, 20 wards, 50 beds each	1,000
For écloppés and the vesicated, 5 wards, 50 beds each	250
3 Bessonneau hangars for the vesicated and prisoners of war, 150 beds each	450
Total	3,380

The necessary personnel will vary according to the necessities of the moment. When the hospital is functioning at its full capacity, it needs:

	Officers	Enlisted men
3 auto-chairs	39	102
20 surgical teams	40	60
10 field ambulances	80	380
Sections of evacuation hospital	12	52
Reinforcement H. O. E.	12	250
Specialists:		
(a) Otorhinolaryngologist	1	1
(b) Odontologist	1	1
(c) Radiologists	3	3
Total	188	849

To this it is necessary to add: For litter bearing, 240 territorials; for automobile transport, 60 enlisted men; for the supply train, 52 chauffeurs; female nurses, 104.

Total to be rationed about, 1,500.

The service of an operation table is provided by two teams which alternate on the tertiary system as follows: Team No. 1 from 5 a. m. to 1 p. m. and from 9 p. m. to 5 a. m., a total of 16 hours; team No. 2 from 1 p. m. to 9 p. m., 8 hours. The next day team No. 2 does the 16 hours' duty and team No. 1 the 8 hours.

Average number of patients operated upon per table, for 24 hours: Badly wounded, 20; lying wounded (moderate severity), 30; sitting wounded and slightly wounded, 100.

Six tables for hospitalization yield 120 operations on seriously wounded in 24 hours.

Six tables for lying wounded to be evacuated yield 180 in 24 hours.

Six tables for sitting wounded, slight cases, 600.

This makes 900 wounded operated upon at this hospital in 24 hours.

According to the intake of wounded, the H. O. E. can functionate at different rates of speed, either accelerated or intense, by reason of the number of surgical teams placed at its disposal by the chief surgeon of the army. If a number of wounded superior to the operative capacity of the H. O. E. should arrive, the commanding officer of the hospital, in constant communication with the chief surgeon of the army, would receive reinforcements or would evacuate wounded not operated on upon neighboring surgical centers. After having received notice from the consulting surgeon of the army as to where they may be sent, these wounded would be evacuated by auto or by train. The commanding officer of the hospital ought to be always in liaison, first, with the group of the field hospitals of the corps, and with the fourth bureau of the general staff to request mixed trains in case of necessity for *éclopés* or permanent trains for the wounded; second, with the regulating station by means of its regulating commander of trains (*commissaire régulateur*) and the sanitary regulating center.

SURGICAL LIAISON

The commanding officer of the H. O. E. should place himself in communication:

First. With the centers to which he must evacuate in the zone of the lines of communication, which are in this case 1,000 beds, with the idea of deflecting the motor ambulances arriving with wounded to them when the operative capacity of this H. O. E. is exceeded.

Second. With the regulating station, through its military regulator of trains (*commissaire régulateur*) and the regulating sanitary center.

Third. With the chief surgeon of the army. From the moment when the operative capacity for 10 hours of work in periods of calm is going to be attained the chief surgeon will then send reinforcements or direct evacuation on a neighboring center.

Fourth. With the groups of field hospitals of the corps.

Fifth. With the fourth bureau of the general staff, to requisition permanent trains or mixed trains for *éclopés*.

Sixth. With the surgical centers on which will be eventually evacuated the wounded not operated upon at the H. O. E. receiving them, by liaison with the consulting surgeon.

SERVICES OF TRIAGE

"Triage" means the reception and inscription of those patients admitted and their distribution in the different quarters for hospitalization or evacuation. The wounded and the sick brought to the triage by the motor ambulances come: First, from advance sanitary formations—(a) from divisional posts; (b) from the groups of field hospitals of the corps. Second, directly from their corps; that is to say, units which are not parts of divisions.

The motor ambulances are always waited for and discharged rapidly and with due precaution by the litter bearers of the triage under the supervision of a noncommissioned officer. The patients admitted are deprived of their arms and equipment, taken to the room for change of clothing, and only preserve their personal effects, which are examined to avoid the entrance of explosives into the hospital. Those admitted sitting take their place on benches holding four. Those lying are placed on the litter supports. The medical officer in charge of this service then sorts them into different categories: First, the sick, sitting, or lying—(a) those with acute diseases not contagious; (b) the tuberculous cases; (c) the venereal and cutaneous diseases; (d) the contagious diseases, etc. Second, the wounded—(a) the evacuable cases, sitting and lying (these are sent to the quarter for evacuation); (b) the nonevacuable cases, sitting or lying, are sent to the quarter for hospitalization. Third, the *éclopés*.

The clerks commence the inscription for admission by making out the "carnets de passage" (admission slips) appropriately for each category. The carnet de passage is made out in triplicate; one copy accompanies the wounded man, another is sent to the War Office, and a third remains in the archives of the H. O. E. During the inscription the medical officer in charge hastens to determine the most serious cases of wounds and illness to give them first attention. He assures himself that the wounded have received the antitetanic serum, and if they have not he gives it to them himself in the dressing room.

SERVICE OF EVACUATION

The service of evacuation executes the order for the evacuation of wounded and sick received at the H. O. E., according to the manner prescribed by the ward surgeons. Wounded and sick can, as a matter of fact, receive many destinations, either:

First. They may be sent to formations in the zone of the interior (Z. I.) or the zone of the army (Z. A.) for the continuation of their treatment.

Second. They may be evacuated on sanitary formations of the army specialized for the treatment of certain medical or surgical affections (contagious diseases, venereal diseases, fractures, etc.).

Third. They may rejoin their units at the front after cure, with or without leave of absence on account of convalescence.

EVACUATION BY SANITARY TRAINS

Sanitary trains are of many categories:

(a) The permanent sanitary trains (T. S. permanent). These are for the exclusive use of gravely wounded lying patients that are transported in beds, and are always sent to Paris.

(b) Semipermanent sanitary trains (T. S. semipermanent) for the wounded and sick, sitting and lying, directed to the zone of the interior or the zone of the army (Z. I. or Z. A.).

(c) Mixed improvised sanitary trains (T. S. improvisés mixtes), sitting or lying, or only for sitting or for lying. These do not function except in intensive periods, in which the destination is the same as for the semipermanent trains.

(d) Ordinary or commercial trains reserved for the transport of *éclopés*.

The permanent sanitary trains do not receive any but French lying wounded. There is an absolute exclusion of the sick and all Mussulman or native patients.

The semipermanent trains for the zone of the interior receive all sick or wounded, lying or sitting, French or foreign, who can not be returned to the lines within five weeks. These trains also evacuate the prisoners of war.

The semipermanent trains for the zone of the army receive all sick or wounded, sitting or lying, French or foreign, that can be sent back to the lines within five weeks.

According to necessity, the sanitary trains are requisitioned for directly by the commanding officer of the H. O. E. on the regulating medical officer and the regulating station of the Army. The call for a train should state (1) the category of train demanded (T. S. permanent, semipermanent, etc.); (2) its composition (number of sitting or lying); (3) its destination (Z. I., Z. A., and, in the latter zone, whether Paris, or a unit near or a unit far from the H. O. E.).

In periods of moderate activity the service of evacuation does not make any special requisition for trains. It sends to the medical officer regulating the trains by telephone every day, at 4 o'clock in the afternoon, a statement as to the number of evacuable patients from the H. O. E. The regulating station receives a like notice from the H. O. E.'s of the whole region and provides, according to necessity, a train called "*de remassage*" for an expressed category of patients.

LOADING OF SANITARY TRAIN

When the regulating station has announced the arrival of a sanitary train, the hour, and the character of the evacuable patients to be loaded thereon, the service of evacuation advises the ward surgeons to prepare their sick and wounded. At some time before the hour fixed, those to be evacuated are taken from the wards by the bureau of evacuation and conducted to the evacuation wards near the railway platform. There a medical officer sorts these cases as follows:

(1) According to destination: (a) Sick; (b) wounded; (c) cases requiring attention of a specialist.

(2) According to the mode of transport: (a) Sitting; (b) lying.

(3) According to the character of the patient: (a) Officer; (b) lying; (c) Mussulmen; (d) natives.

This officer assures himself that all of those to be evacuated can endure the fatigues of the trip; he verifies the details of the diagnosis, the fact as to whether they have received antitetanic injections or not, the care to be given them in the course of their trip, their diet en route, etc. The patients to be evacuated will be properly fed and provided with clothing and foot covering. From the moment of the arrival of the sanitary train at the train platform for embarkation the loading is performed by the H. O. E. and the train force by mutual cooperation. The embarking officer gives a nominal list of the sick and wounded to be evacuated to the commanding officer of the train, who verifies its correctness in his presence. The convoy once under way, the service of evacuation notifies the regulating medical officer of the load, with its classifications, numbers of officers, Allies, Mussuhnen, and prisoners of war, and indicates the hour of departure of the train.

EVACUATION UPON SANITARY FORMATIONS OF THE ARMY BY AMBULANCE

Certain sick and wounded are evacuated on sanitary formations of the Army—to specialists in the treatment of medical or surgical affections, such as wounds of the eye and orbit, fractures, venereal cases, contagious diseases, nervous complications. The transportation of these patients is made by automobile ambulances of the motor ambulance convoy (S. S. A.), on duty at the H. O. E. Mental cases are always accompanied by a medical department soldier charged with their surveillance en route. A constant liaison between the H. O. E. which evacuates and the sanitary formation that receives is maintained; the evacuation of every sick or wounded man is announced by telephonic message. The motor ambulance convoy (S. S. A.) is also employed for the transportation of sick or wounded from the units which are not part of a division and which request transportation from the commanding officer of the H. O. E.

EVACUATION BY REASON OF CURE

It is the slightly wounded and slightly sick proceeding from the field hospitals of the corps, or from units which are not part of a division, able to return in a few days—eight at the outside—that are directed to rejoin their corps after cure. On admission, the services which have treated them give the details for their evacuation to the bureau of evacuation, which inquires into the whereabouts of their unit of origin, and thus is in a position to secure their return without fail to their units when they are cured. The service of evacuation assures itself in addition that these men are equipped, except when they have to pass through the regulation station to rejoin their unit. In such cases they are rearmed and reequipped by the depot of reequipment of the regulation station. Each man leaving the H. O. E. on account of cure is furnished with an order to rejoin his formation. This order expresses the hour of departure and the route over which he should go. The bureau of evacuation consists of a medical officer, an officer of administration, and six clerks, divided into two teams, which perform their duties at eight-hour intervals.

MANNER OF FUNCTIONING OF THE PHARMACEUTICAL SERVICES

This station comprises, in addition to the preparation of medicaments, all the technical service required for surgical sterilization, for the general hygiene of the H. O. E., for the salvage of cotton and gauze for dressings, for the manufacture of ice, and, by assimilation, the surveillance of the vegetable gardens and farm created for the purpose of bettering and varying the food of wounded and of the personnel of the hospital. The pharmaceutical service, properly speaking, comprises: (1) The central pharmacy of the hospital; (2) the special pharmacy for the specialist's infirmaries; (3) the reserve supply of drugs.

THE CENTRAL PHARMACY

The central pharmacy of the hospital prepares and delivers the medicaments prescribed by the ward surgeons, as well as the dressings, ligature material, sterilized dressings, etc., necessary in the surgical service. The pharmaceutical and surgical preparations vary according to the preference of the physician or surgeon, as far as drugs and antiseptics are concerned. However, certain products are prepared daily in large quantities, such as liquid soap, iodized benzol, used for the general cleansing of wounded in the preoperating room, and liquid antiseptics of current use, such as the solution of Manciére and Dakin's solution.

For the treatment of the vesicated the central pharmacy furnishes to the gas quarter bicarbonate solution, alkaline powder for burns, calcium soap liniment, and solution of sucrate of lime.

The central pharmacy cares for all rubber goods, such as oxygen balloons, ice bags, hot-water bags, rubber tubes, etc.

All of the teas for the wounded are prepared at the tea house, which is a dependency of the pharmacy. The drinks usually prepared are coffee, milk, tea, lime-juice drinks, herb teas, tartarie lemonade, and the vinous tartaric lemonade.

A chemical analytic laboratory, an annex of the pharmacy, permits investigation in clinical chemistry, besides the analysis of some foodstuffs and all drugs in a doubtful state of conservation. The chief pharmacist has to secure compliance with the law concerning poisonous substances. He has to inspect the different services of the hospital with a view of verifying the good state of preservation of some drugs and antiseptics on constant use in the wards.

THE PHARMACY FOR THE SPECIALIST'S INFIRMARIES

This is a special pharmacy installed in the barrack quarter of the special medical and surgical consultants, which is charged with preparing and delivering to the consultant surgeons from the phtharmological and otorhinolaryngological and dental services the medicines prescribed by these specialists. The pharmacy is also in charge of the delivery of trusses for hernia, elastic bandages, required stockings for varicose veins, and the suspensory bandages required by the consulting surgeons, to those who present prescriptions signed by the medical chief of their formations.

THE ADVANCE RESERVE SUPPLY OF DRUGS

This is installed in a special barrack building and hangar and is for the purpose of delivering to sanitary formations of the Army, to regiments, to isolated services, to cantonment infirmaries, to sanitary teams, to parks of artillery, and aviators, etc., those drugs and disinfectants that they need. This formation prepares and delivers, also, dressings and therapeutic products for the treatment of the vesicated and issues all of the preventive apparatus against asphyxiating gases. This latter material, such as masks, Tissot apparatus, Draeger apparatus, oxygen tanks, spare parts for these various apparatus, etc., is regularly verified and carefully looked out for.

SERVICES OF STERILIZATION

The service of sterilization, which will be made the object of more detailed study, furnishes to operating groups, to the dressing rooms, to the ward surgeons, etc., all sterilized material, such as cotton, gauze, compresses, gloves, instruments, syringes, operating-room linen, etc.

GENERAL HYGIENE

This complex service solves all the questions which concern directly or indirectly the rules of hygiene, such as: Javellization of drinking waters; general police of the camp; hygiene of the cantonment; police of kitchen and inspection of food; disinfection and deodorization of latrines; disinfection of men's effects, all personal linen, bed linen, and other linen for different uses; disinfection of ambulances used for contagious cases; incineration of old dressings, linen hopelessly stained with blood or rust; the police and deodorization of the morgue; campaign against rats, flies, and microbes.

SALVAGE OF COTTON AND MATERIAL USED FOR DRESSINGS

Cotton bandages, compresses, and objects for dressings, susceptible of being again used, are recovered, sorted with care, and sterilized. The bandages, compresses, operating-room towels, etc., are immediately washed with care, rinsed, and folded or rolled again for fresh usage.

MANUFACTURE OF ICE

An ice manufacturing plant can produce 500 kilos. a day, and works near the hospital. The ice thus prepared is intended for surgical and medical uses in the hospital and for the sanitary formations which are near the hospital.

THE TRUCK GARDEN AND FARM

In order to employ the idle moments of certain working parties, there has been created on land appertaining to the hospital a truck garden comprising 2 ha. of land, for the cultivation of potatoes, peas, lettuce, beans, cabbages, carrots, turnips, parsley, spinach, etc. These vegetables permit of variation and improvement in the régime of the sick, and provide fresh food for the enlisted men among the personnel. Greasy water, garbage, etc., is used to fatten pigs, rabbits, and chickens.

CENTRAL STERILIZATION

The central sterilization plan comprises a Geneste-Hercher autoclave, which also furnishes steam for two boilers, and another autoclave, O. M. 34. The larger door of the Geneste autoclave opens through a partition entirely separating the interior of the sterilizing plant properly speaking, which itself is divided again as follows into, first, a room for the preparation of dressings, etc.; second, a room containing a reserve of sterilized dressings and instruments; and third, a distributing room.

Sterilization of dressings.—The compresses, the cotton batting and absorbent cotton, the operating towels, etc., are placed, each in its own class of boxes, and all sterilized in the Geneste autoclave for an hour and three-quarters at a temperature of 134° C. with a registering manometer and capillary glass tubes, testing efficiency of the disinfection by a color test in the center of the dressings (sulphur and a trace of methylene blue which fuses at the proper temperature for sterilization). At the end of this time a vacuum is created for 10 minutes to dry the dressings, and then the boxes are removed, care being used to close the openings through which the steam has passed previously.

Sterilization of instruments.—The gloves are well cleaned and dried, the fingers and thumb of the hand are slightly dampened with a solution of formol of 40 per cent and the glove turned inside out. A cuff is turned back for the purpose of leaving the hand of the glove open and the glove is wrapped in gauze with pieces of same between the fingers and placed in a metal box which is placed in the autoclave and subjected to a temperature of 80° for 45 minutes, just as the instruments were.

Sterilization of syringes.—The syringes are cleaned, boiled for 15 minutes and dried. They are then separately wrapped in filter paper, leaving one end open, into which one introduces 10 drops of ether before closing. They are now sterilized for 20 minutes at 110° C. and are dried in the autoclave by a vacuum.

The central sterilizing plant sterilizes every day the dressings, instruments, and gloves necessary for the hospital wards of the operating rooms.

BACTERIOLOGICAL LABORATORY, AUTO-CHIR 19

When the wounded man arrives at the auto-chir, specimens are taken, either from the serum at the bottom of the wound, or from a bit of clothing or projectile extracted by the surgeon during his intervention. These are sown in cultures: First, cultures for aerobes on an agar slant; second, cultures of anaerobes on Veillon agar which grow in the deeper portions and, separately, dilute agar cultures for anaerobes in the Vignal tube.

These cultures are left in the incubator at 37° C. for 12 to 14 hours, and the result is then communicated to the surgeon.

Cultures at the time of dressing.—In the course of the various dressings performed, specimens are taken of the pus, which is examined first, by smears on glass slides, which serve for the enumeration of the microbes and the establishing of the bacteriological chart; second, by cultures taken from the pus to determine the quality of the infecting microbe.

For the primary and the primary delayed sutures the surgeon has at his disposition first, cultures that show him the quality of the microbes in the wound, particularly with reference to the presence or absence of streptococcus; second, a bacteriological curve giving him the quantity of the microbes contained in the wound, in the course of its healing.

THE SPECIALISTS

The otorhinolaryngological services

This service functions in such wise as to permit of a dispensary as well as the hospitalization of wounded or sick.

The dispensary service.—This takes place every day from 9 to 12. There are received sick from the corps, the divisional depots, and divers organizations in the neighborhood. After examination of the patient the result is inscribed on an individual diagnosis tag that remains at the dispensary, and also on a slip called a "consultation slip" taken back by the patient to the surgeon that requested the examination. This slip also bears an indication to this surgeon of the method of treatment which should be employed at the organization from which the patient came, the decision as to the nature of the disease and the precautions to be taken, with the exemptions from duty which may be permitted. Prescriptions, if such are necessary, are filled for the patients by the pharmacy for the specialists installed in this barrack quarter. In this wise are examined also the sick of other services of H. O. E. and also some civilians.

The hospitalization section.—The wounded are received as well as the sick and they get special care where it is impossible to give it to them in their corps, and in such cases where the patients need operative intervention. The time of hospitalization varies from 15 days to 3 weeks. If a patient is intransportable or needs long treatment, he is evacuated. In short, these services permit treatment of sick and wounded of the Army, the great majority of which can rejoin their corps directly, and it facilitates the salvage of these men to their troops.

Service of the gas center

The vesicated and those suffering from yperite.—The composition of the gas: The vesicant gases employed by the Germans are generally on a base of dichlor-ethyl-sulphide, associated with other substances, particularly with the tetrachloride of carbon.

Immediate effects: Vesication of the mucous membrane of the conjunctivæ, and the nasal and pharyngeal mucous membrane. Also vesication of the skin, particularly of the neck and armpits, and the folds around the anus and the scrotum.

Late effects: Ulceration of mucous membrane, tracheitis, bronchitis, bronchopneumonia, edema of the lung, and death.

Treatment: Should be given as soon as possible to limit the effects of gas and to prevent complications, such as bronchopneumonia, etc. To this end—

a. We should disrobe the patient entirely, taking away his outer clothing and soiled underclothing loaded with yperite. He should pass under a warm douche of soapy water, or, better, one which contains carbonate of soda (1 to 1,000), or limewater.

b. The mucous membrane should be washed, such as the eyes, nose, mouth, pharynx, with one of the following warm solutions: (a) Lime solution, composed of limewater and distilled water, equal parts; (b) solution of saccharate or sucrate of lime, composed of sugar, 15 gm.; slack lime, 15 gm. to 1 liter distilled water; (c) solution of bicarbonate composed of chloride of sodium, 14 gm.; bicarbonate of soda, 40 gm.; distilled water, 1 l. These lavages are repeated two or three times a day as long as it is considered necessary.

c. In case of vesication of the skin it is necessary to dust with neutralizing powder as follows: Tale, 40 gm.; carbonate calcium, 20 gm.; carbonate of magnesia, 20 gm.; oxide of zinc, 20 gm.

Gassed patients are examined and treated wherever necessary by the ophthalmological or otorhinolaryngological services, and these specialists are notified in all cases where lesions are produced in the organs in which they are specialized.

In general the following remedial agents are employed: The various collyria and inhalations, and fumigations with eucalyptol and benzoate of soda, also spraying with gomenol oil (10 per cent in the throat, nose, etc.). The duration of the treatment varies, according to the gravity of the lesion, from some days to a month. The preparation of the sweetened solution of the sucrate of lime is as follows:

1. Dilute with greatest care 12 gm. of slack lime, washed in 150 c. c. of distilled water.
2. Dissolve 25 gm. of sugar in 50 c. c. of distilled water.

3. Mix the milk of lime with the cold sugar solution and leave it in contact for 24 hours.

4. Decant with care or filter and place in a flask.

Prepare the solution of the succrate of lime for washing out the eyes of the yperited by diluting the mother liquid of the succrate of lime in the proportion of 40 c. c. to 1,000 c. c. of water.

Disimpregnation of the clothing.—The clothing of gassed cases is handled by enlisted men of the Medical Department properly protected by masks, waxed clothing, and mittens. The clothing of those who have been gassed lightly is assembled, beaten, hung up, and exposed to the air for 48 hours in an open drying shed. That from the severely yperited is soaked in water at 80° or 85° for an hour and then dried in the air.

Disimpregnation of arms, leather articles, and munitions.—Rough dirt is removed by rags, which are immediately destroyed. The contaminated articles are powdered with dry chloride of lime, which is left on two hours and then washed in plenty of water.

Disimpregnation of ambulances and trucks.—All that have been used to transport gas cases are disimpregnated with the Vermorel apparatus, by a solution of chloride of lime, 1 to 4. For the disimpregnation of certain localities the same process is used.

Gas intoxications

These intoxications are especially due to suffocating gases, palite, superpalite, arsine, bromacetone, chloropierine. They can be light or serious.

(a) Treatment of light or medium intoxication: Ipecac to the point of nausea, inhalations of oxygen, wet cups, or blood letting to 500 gm. cardiac stimulation by sparteine or camphorated oil in large doses.

(b) Treatment of serious intoxication accompanied by acute edema of the lung: Repeated blood letting, cardiac tonics—sustained at regular intervals—oxygen subcutaneously and frequently repeated. In all of this treatment there should be complete abstension from opiates, especially morphine.

Dental services

The dental service of the H. O. E. has a double rôle to fill.

1. An operating dental office for extraction, filling, and cleaning teeth, etc., for the personnel of the H. O. E., for the sick and wounded of the hospital, and for the formations which are not in a division cantoned near by.

2. The prosthetic workshop, which furnishes bridges to those of the enlisted men who lack teeth for mastication.

THE GENERAL PRINCIPLES OF TREATMENT OF GUNSHOT WOUNDS

By M. L' Medecin-Major seconde classe terracol

The surgeon on duty who dresses a wound of war ought always to bear two objects in mind: First, to prevent infection; second, to make an anatomical, and especially a functional repair of the parts damaged by the projectile.

1. *To combat infection.*—(a) Every wound produced by a projectile in war ought to be considered as infected by the projectile and the clothing that it carries in with it.

(b) The only treatment that can be employed to combat infection consists in opening up the wound to the air and surgically cleaning it by cutting instruments.

(c) In general, up to the sixtieth hour, there is comparatively little reaction "phase de sideration", from there on the germs multiply and are diffused.

(d) The quality of the microbe in the wound is more important than its quantity. the streptococcus is to be especially feared, whether alone or associated.

The conclusions to be drawn from these axioms are as follows: The operation should be done early and completely with extraction of the projectile, with removal of the contused and devitalized tissue, the debris of clothing, etc. This should all be controlled by bacteriology. There is only one contraindication to this procedure—that is to say, shock, with the exception of hemorrhagic shock, if it is possible to separate it out clinically from simple shock. In the case of shock we have many means at our disposal such as heating, transfusion, and tonics, and we should lose no time in bringing a patient to surgical intervention to avoid the consequences of delay.

2. *The anatomical and functional repair of the tissues.*—(a) These are the easier when infection has been prevented.

(b) We must avoid extensive removal of soft parts and bone.

(c) Intervention is all the more efficacious and complete when it is done early. The matter of sutures following the operation should be under the control of the bacteriologist.

FUNCTIONING OF THE SURGICAL SERVICES

On account of the specialization of the services at this hospital and its distance from the line, the wounded treated are those of the soft parts and the articulations, some fractures, rarely brain or cranial wounds, never abdominal nor serious open thoracic wounds, except when these accidents are produced in the zone near this formation.

Arrival of the wounded at the triage of the operating group.—(1) Examination by the orderly officer of the day.

(2) Undressing and general cleansing.

(3) Transfer to the preoperating ward.

(4) Examination by the surgeon on duty, who determines whether the wounded man is operable or not.

Nonoperable wounded.—Transfer to shock room and proceed with antishock treatment, such as heating, lowering of the head, administration of adrenaline and normal salt solution under the skin, the administration of cardiac tonics, and the transfusion of blood according to Jeanbreaux's method under the supervision of a medical officer.

Operable wounded.—(1) Cleansing of the borders of the wound; shaving.

(2) Transfer to the radiograph room, where every wounded man is examined under the X ray.

(3) Transfer to the operating room.

Radioscopic and radiographic examination.—In the majority of cases radioscopy suffices. The localization of the projectile and its exact position in the tissues is determined by Strohl's method, which is excellent from its rapidity, its facility, and its exactness. In cases where there are multiple fragments or where those fragments are in difficult situations, they are generally extracted under the operating screen or "bonnet" on the X-ray operating table.

In a wounded man with serious wounds requiring rapid action, the fragments which are in difficult surgical position are removed later on under the guidance of the Hirtz compass, in which case a radiograph has to be made and radioscopy also employed.

In case of fractures, a radiograph is taken, front and side views.

OPERATIVE PROCEDURE

Soft parts.—Application of methods in actual general use: Removal of the borders of the wound, débridement plane by plane, excision of ischemic tissues, removal of the projectile. The principles which should govern are: Remove wounded tissues if the sacrifice of such tissue does not produce too much damage and does not wound any important organ. Another principle is to open well the chamber of attrition. These principles should be applied to all shell bursts. In the treatment of wounds by bullets there are two situations.

(1) The wounds with punctiform orifices: If the borders are clean, paint them with tincture of iodine and put on a dressing. If the borders are lightly torn, excise the skin and suture immediately.

(2) Large orifices: Procedure is the same as for a wound caused by a shell burst, but with the difference that the contused tissues are more superficial and the muscles bleed immediately upon cutting; there is no debris of clothing. When there are not too many of these wounded at one time primary suture should be done, but when there is a great rush the delayed primary suture should be considered.

To suture or not to suture?—The ideal that one pursues when the wound is wide open, the flesh well explored, and the projectile removed, is to suture primarily, after cleaning with ether. When dusting with Vincent's powder one should not suture hermetically if the wound is deep, but should leave a drain at its most dependent part. The drain is best composed of silkworm gut permitting capillary drainage.

A quantitative bacteriological examination, and above all, a qualitative, to determine the presence of streptococcus.—It is necessary to watch the temperature, but better the pulse and general condition. If streptococcus is found, open the wound. If straphylococcus, watch it carefully. If other cocci or banal germs, wait. At the end of three or four days remove the capillary drain and examine it bacteriologically. The important thing is to secure a complete hemostasis. If the wound is deep and rather old, the cleaning is difficult and one must drain. Apply a Menci re dressing, Vincent's powder, or Carrel tubes. Make a bacteriological examination immediately at the first dressing and make a qualitative and quantitative analysis of the deep and superficial parts of the wound. When you find only 1 microbe to 4 to 10 fields after two successive examinations, suture immediately (primary retarded suture). If there are bacteria in a quantity superior to the above, irrigate with Dakin's solution and after sterilization do a secondary suture. The important thing is to rapidly close with suture to avoid formation of fibrous tissue, adhesions, a puckered scar, necessity of resection, and the risk of opening up new foci of microbes. Powder of Vincent should be placed on the suspicious parts of the wound where hemostasis might not be complete, and the capillary drain should be withdrawn after 48 hours and should be subjected to bacteriological examination. The deep suture should be of catgut; suture of the skin should be performed with silkworm gut or metal clamps.

Fractures.—Same treatment as for the soft parts. Removal of the edges of the wound, excision of contused tissues and, in general, except when there are too many wounded at one time, make a radiograph. Removal of splinters freed from the periosteum. Adherent splinters should be subperiosteally resected when they prevent access to the medullary cavity. Strict immobilization, either in plaster apparatus with metal supports, or, frequently, by the suspension apparatus of Blake, with traction to permit irrigation and disinfection by Carrel's method. It is not advised to do a primary plating of the fragments. In general primitive sutures in fracture cases are not advised except in the case of fractures with few splinters and with osseous damage that is well exposed and superficial.

Articulations.—The principle is to close immediately or nearly immediately, under the control of a bacteriologist. For the knee, except in the cases of deep-lying projectiles or serious shattering of bone, a lateral or bilateral arthrotomy is advised, with a thorough cleaning of the wound cavity by ether. Generally, no division should be made of the patella tendon. In case there is a "laparotomy of the knee" in the above mentioned cases, the patella tendon should be perfectly sutured, followed by immobilization either by plaster reinforced by a posterior splint, or by suspension. The knee should be early mobilized and the patient should be gotten out of bed soon. No other articulations require any special mention.

Cranial wounds.—Exploration of every wound of the scalp and application of a primitive suture. When there is a lesion of the underlying bone, trephine or enlarge with biting forceps. In case of a lesion of the bone, without opening the dura, suture immediately. For intracranial projectiles, extract under the screen; extract all foreign bodies with an ear forceps, and in the case of projectiles that are accessible and well seen, extraction should be immediate in order to profit by the track of the projectile.

Amputations.—The conservation of a limb is imposed to the extreme limit except in cases of very extensive destruction of the soft parts or of the bones, or in case of lesion of vascular organs which compromise the vitality of the limb, or in grave infections. The object is to preserve the maximum of length of a limb in order to apply a prosthetic apparatus. For patients who are suffering from shock, a circular amputation is done. Recovery being rapid, a prosthetic apparatus should be applied temporarily—best a plaster apparatus.

Gas gangrene.—This is now exceedingly rare. There are light forms and localized forms known as gas phlegmons. They disappear after being opened up to the air (*perfringens*). Vincent's powder or Dakin's solution can be used and secondary suture practiced later.

There are no cases of tetanus in this hospital, and injections of serum are repeated twice.

There is no particular method followed for the wounds of the vessels nor of the abdomen, or chest, except that in the latter it is well to extract large shell fragments in the lung which might cause complications.

Army Sanitary School No. 83.

VISIT TO H. O. E. 22

This hospital is situated near the H. O. E. at ——— and has more tents than huts. It is a comparatively new hospital and its capacity is 2,800 patients. It was originally intended for slightly wounded, but now receives all kinds, as it is comparatively near the line. It is a beautiful place, in rolling country, and very clean, being well administered. There are 80 Bessonneau tents and 4 Bessonneau hangars. The medical officer in command had been gassed by CO from riding in a French ambulance and was unable to go about with us. We were taken about by a major, his second in command.

The triage consists of four barracks parallel to each other, as at B———. One for sick, one for recumbent cases, one for sitting cases, and one for pack store, in which to put equipment and clothing, but, in addition to this there was a Bessonneau hangar for a large number of sitters—300. The floor was sanded and it was noticed that in place of trestles for litters they had square frames of scantling, very solid, for two litters each. The seats and trestles had been painted white and were neat and clean. It was temporarily being used for a shelter. The grounds are well parked, with solid roads, good gutters, gravel walks, and flowers in every direction. There are three operating groups in this hospital, which has four operating tables for serious operations and two tables for dressings. The general arrangement of these operating groups is the same for all three. On either side are two large Bessonneau tents and farther away some barrack wards for hospitalization of nonevacuable surgical cases. One of the operating tables for serious cases is in the X-ray operating room. There an operation can be done on an aluminum table by means of a fluoroscopic bonnet. It was stated 12 teams could work in each group. The ward on the left, as one entered, was used for badly wounded or cases recently operated upon which could not be moved immediately to the ward. Bessonneau hangars are set up in 3 or 4 days by teams sent from the army. The small Bessonneau tents for wards require three hours to set up. The floors were generally sand or gravel, but now and then of wood. These tents held from 15 to 20 comfortably, with iron enamel cots, but in a push, using litters, they will hold 30. There is a *groupe complementaire de chirurgie* that has a radiologic outfit yielding 110 volts which is sufficient to run the X ray and 400 lights at the same time. In the surgical wards, which were neat and clean, we noted the following cases:

Case 1. Two penetrating wounds of the knee; immobilized.

Case 2. An occlusion of the rectum by a neoplasm and cirrhosis of the liver.

Case 3. A man with a watch blown into his buttock.

Case 4. Compound fracture of the humerus.

Case 5. Multiple wounds and severe shock. Compound fracture of the humerus, a large missile in the tibia, and wound of the buttock. At the time he was received he was well advanced in gas gangrene. Local débridement was done and the Carrel solution begun.

Case 6. Tuberculosis of the cecum, with successful cecectomy.

They state that they can handle 1,200 surgical cases a day in this hospital. The evacuation portion is distinguished from the hospitalization quarter. There are 21 Bessonneau tents for the slightly wounded and a Bessonneau hangar for the overflow. The slightly wounded remain only 24 hours, as a rule. There are separate tents for the medical cases and a separate tent and room for the slightly wounded. In all there were 42 evacuation wards. The patient must be sent to the evacuation ward an hour before train time. They were all beautifully clean and in good order.

The laboratory was equipped with a laboratory outfit contained in six chests. These chests are the regulation equipment of the French Army for a mobile laboratory.

THE PHARMACY

This is one of the best pharmacies we saw. It was a large frame building with windows for dispensing prescriptions and supplies to ward orderlies, thus preventing their roaming around through the prescription room to the interior of the building. Everything had its place and was in its place, and there was plenty of room for flowers, which decorated the tables. We were told that there were three classes of articles which could be supplied in this pharmacy which was strictly for the H. O. E. and not an advance medical supply depot.

- (1) Articles on the supply table which are always kept on hand.
- (2) Articles on a list which can be sent for on demand.
- (3) Articles kept to suit the individual practice of the surgeons.

We were told that each division of the Sixth Army has its own advance medical supply depot.

THE CENTRAL STERILIZATION PLANT

This was the best of its type that we saw. This is a new thing in the French Army and is added in order to relieve the operating and surgical wards of the labor and confusion of sterilizing their dressings and instruments. A similar plant, but not so large nor complete, was seen at H. O. E. 32 and H. O. E. at ———. The French gamelle is here used, not only for gauze squares, but rubber gloves also. On entering the plant, which is separate from the rest of the hospital, one goes into a corridor into which opens two windows, through which are passed, from the room within, the dressings and instruments needed. This room is kept for a distributing room, to which all of the sterilized material is sent when completed. It was very clean and orderly and filled with tin boxes containing sterile dressings, etc. We then entered the room for making dressings, into which opened the rear door of the autoclave (Geneste-Hercher). This room had a large table on which were prepared dressings by some Red Cross nurses dressed in white. A sharp saber was used to cut gauze squares the proper size. It cut through a thickness of 4 or 5 inches. This gauze was packed into a gamelle or French soup tin with handles, a layer of cotton batting is placed over it, and after sterilization the cover, which lies loosely and which is tied to one of the handles, is forced over the rim covered by the cotton batting to prevent air infection of the contents. The Geneste sterilizer here was somewhat differently arranged from that at ———. There was an automatic cylinder for recording the temperature variation on a chart. Into the center of the dressings or linen placed in the box for sterilization was the usual small capillary tube containing methylene blue and sulphur for checking on the degree of heat reached in the center. The dressings were subjected to two and one-half hours at 134° C., the air being previously expelled from the interior of the autoclaves before the steam was let in. Gloves and hypodermics were sterilized here also in separate containers. At the end of the building was a large storeroom with extra dressings, cotton, bandages, gloves, etc.

Note on the autoclave and the manner of its use: This autoclave is horse drawn and was originally intended for clothing. It is very well made. It is known as the "machine Geneste-Hercher," 4 Rue de Chemin, Paris. The cage holds 250 gamelles at a time. It burns 4,000 kilos of coal a month.

In this hospital we noticed a case of pneumonia in which they injected turpentine into the thigh to produce an abscess and increase the number of leucocytes in order to combat infection.

Army Sanitary School No. 86.

ORTHOPEDIC SURGERY

Lecture by Major Allison

The splinting and care of the wounded man from the time he receives his wound until he reaches the evacuation hospital has fallen under the direction—that is, the professional side—of the division of orthopedic surgery. This, of course, is because of the splinting, which is necessary. Along with the splinting comes the treatment of shock. The recent work done by Major Cannon and others on shock has shown that the important stage is the early stage—that is, a zone exists which might be called the zone of shock—shock and hemorrhage. The wounded man receives his wound and has to be carried to a battalion aid post. In this transit most of the severe shock arises, and it is interesting to us to note that Major Crile, who has for many years made a study of surgical shock, has recently stated that in his opinion the most important factor in lessening surgical shock where fracture exists is the application of traction to the fractured extremity through the Thomas splint. Along with this are the other elements—fear, loss of blood, and cold. It is in regard to this particular region or zone through which the wounded man has to pass that I want to bring out some points, if I can, of what we have learned and are learning since our 1st Division went into actual combat in January.

The surgery of a combat division.—The surgery of a combat division may be put, I think, briefly, under three heads. Transportation of the wounded is, perhaps, the most important head; the treatment of fractures and shock and hemorrhage are next; and, third, is the care of troops, the orthopedic care of troops, who are in the field. Under this last head comes the prevention of trench foot, and the inspection of shoes and footwear, in the rest areas when a battalion or a regiment is in rest. The battalion surgeon is the man with whom we are chiefly concerned. The battalion surgeon, to my own point of view, occupies one of the most important positions in the care of the wounded. His duties call for a high type of character, and call upon initiative and invention; he is the man on whom the principal stress falls in the treatment of the wounded in this area of shock and hemorrhage. His post is insecure; he has to use great judgment as to how long to stay in his post, for as I will show you later, in the last week two of our battalion aid posts fell into the hands of the enemy and one of our battalion surgeons with the medical men at the post were captured. The battalion surgeon is a man who has to have great courage, cheerfulness, and set a very high example. I look upon the battalion surgeon as being the man whom we must chiefly depend upon from the standpoint of true military surgery. The things that occur in the back area are interesting and, surgically speaking, more what we are in the habit of dealing with in civil life; but the position of battalion surgeon is something that is new to most of us; and I must say in passing that the men who are doing this work in our divisions are doing it with the greatest possible credit. In passing, an incident occurred in the 2d Division about 10 days ago. Lieutenant Gordon, who was associated with the work that we have been doing in these divisions, was in a battalion aid post situated in a quarry. Considerable shelling took place and they had to stay under cover. The story of what happened comes from one man who escaped. This man doesn't speak English very well; I think he is probably a Swede. He was in the same post. After the shelling had been going on for some time it ceased, and the next thing they knew they were surrounded by Germans. He and Gordon were taken prisoners and were started back toward the German lines. This Swede who tells the story says he became tired and said he was not going any farther, and the German who had them in charge grabbed him by the seat of the trousers and threw him about 10 feet—an actual fact, he tore the seat out of his trousers. Then Gordon said to him "If you do that again we will both be killed. Just keep quiet; I am going to get this fellow." They walked along farther, and Gordon who had a .45 Colt concealed somewhere about him seized his opportunity and shot the German and they both ran. The Swede got in and Gordon did not get in. What has become of him we do not know. His belt and coat have been found, but not his body. This brings up the question of the battalion surgeon being armed. I have nothing to offer on that point. I admire Gordon's courage tremendously. I fear that he was killed. Of course, he had his chance to escape and he had the Colt, and he used it.

In many of these battalion aid posts that I have visited the question has come up in conversation. When shall a battalion surgeon leave his post? I can not offer any solution of that question. It is quite necessary for him to leave his post, but he must not leave his post before it is necessary, and there is the question. No rule can be laid down. As I have told you, in the 26th Division last week, two of our battalion aid posts fell into the hands of the enemy at S ———, and remained so during 24 hours, when they were retaken, so you see it is quite evident that the position of the battalion surgeon is one calling for considerable judgment and courage in addition to his duty in the care of the wounded.

The next point of importance is the question of stretcher bearers. A combat division, I believe, should have about 1,250 men of the Medical Corps. There are 40 Medical Corps men to each regiment. Of these, 35 are litter bearers. These men should be in the battalion aid post and in the front-line trenches at all times when the regiment is engaged. There should be in addition 35 litter bearers at each ambulance dressing station. These men come from the ambulance companies. With a brigade of Infantry and a corresponding Artillery organization there should be about 200 litter bearers on duty at all times. At the same time in a division there will be 300 litter bearers in rest positions, but available for service in case necessity arises. In addition to these, in each division there are 8 bands of about 30 musicians each; counting out the noncommissioned officers, this would add

about 200 more men available as litter bearers in time of emergency. This makes a total of 700 men available and instructed as litter bearers. These men have all been instructed in the application of splints and in the carrying of wounded and in first aid. Thus there are 700 men for the Medical Department to a division to use as litter bearers. This isn't an adequate number to meet the demands of any sudden offensive, or defensive action, so that in several of the divisions various plans have been taken up. Colonel Shaw, in the 1st Division, procured from his general 100 men per regiment to act as litter bearers in case of necessity. These men are designated, but not instructed. Colonel Shaw looked upon it as simply a question of getting men who could carry wounded men out. This is one solution.

In the 42d Division, Colonel Grissinger has had 700 men, 100 per regiment, designated by the general's order, and these men have been instructed in the application of splints and first-aid treatment.

So there are 1,400 litter bearers in these two divisions who can immediately be called upon. Of course, these men I speak of last are combat men, men from the regiments, 100 men per regiment, who can be called upon in time of necessity to act as litter bearers. The placing of litter bearers is of great importance, in this zone of shock, this zone between the evacuation hospital and the place where a man may be wounded. Two men ought to be with each battalion in the trench or in the position that the battalion may occupy. These men ought to be men of the Medical Corps who understand the application of splints and first aid, and the use of the trench litter and the ordinary litter, and who stay with the battalion in its position. This, of course, is anterior to the battalion-aid post. These men are under the direction of the battalion surgeon. With these two men in the trench, the question arises whether they should come out of the trench—that is, it would take two men at least to make the carry of a wounded man to the battalion-aid post because this distance varies—sometimes it is a thousand yards and sometimes it is over that. It is often a very difficult carry and may take two hours to get a man back that far. If these men leave the battalion in the trenches for two hours to carry back one wounded man, the battalion is left uncovered. Perhaps, a better way of handling this is for the battalion surgeon to send forward men to carry out the wounded man or men. He has 10 men in his battalion-aid post and he can call upon the ambulance company which is stationed near there. This gives him an adequate supply of litter bearers who can go forward, and who can relay each other and relieve the two Medical Corps men with the battalion to attend to the wounded and apply the splints. The arrangement of these details is one of the duties of the battalion surgeon; he must see to it that this relaying and carrying out of wounded is done properly. It is often very difficult—the men become exhausted in these carries. They do it with great courage, or they have in the recent engagements that we have had, and they do it up to the point of physical exhaustion. Some of these men in the last two or three engagements that we have had had to go back to the rear because they were exhausted. I don't mean by that that they were "shell shock" cases. One man that I know of came back with a diagnosis of "shell shock" in the fighting of last Saturday. He had carried a litter I think for over 24 hours. He didn't have "shell shock" at all, he slept for 24 hours without turning. He had all the symptoms of exhaustion. He lost his bearings, he became confused, and didn't know which way he was going, and he was sent back with a diagnosis of "shell shock." This diagnosis hastily made we want to avoid. The man in question had simply passed beyond his physical strength and couldn't carry on any further.

The instruction of stretcher bearers, and the general morale of the stretcher bearer, depends a great deal upon the attitude of the battalion surgeon. The battalion surgeon should, I think, during quiet times instruct these men; have them practice with splints when there is not much going on. The hours of quiet can be used in having the men practice with the splints and get them ready to use and give them various other points, they are keen to learn—they are very much interested in what they are doing; they take pride in the fact that they have a good supply of splints and can get men back in good time. This attitude is a valuable asset to the battalion surgeon in caring for the wounded of his battalion.

The following general order was issued by the general of the 42d Division regarding this so-called zone of shock.

The document closes with following:

The following points are emphasized:

(a) Surgical operations are prohibited except in a hospital. Treatment at the front and during evacuation to the hospital will be limited to the first aid, splints, control of hemorrhage and shock. Probing of bullets or fragments of any sort is expressly forbidden. Every effort will be made to secure delivery of the patient at the proper hospital at the earliest possible moment after receiving injury; saving of time during the early period of injury may mean life or death to the patient. During the evacuation of the patient he must be kept as comfortable as possible. He must be disturbed as little as possible, and in any event after the first dressing and splints are applied only so much shall thereafter be removed as is necessary to see that the dressings, splints, etc., have been properly applied in good condition and are in good shape. Warmth will be continuously applied. It will be secured by hot-water bags, alcohol or other stoves, hot bottles, etc.

By command of Major General Menoher:

DOUGLAS MCARTHUR, *Chief of Staff.*

That is a very remarkable document and covers the situation in a most simple manner, given by the commanding general of a combat division.

We know that in times of the stress of attack and defense all plans are more or less disturbed, and it is interesting in passing to note that it may change at any time. We have settled down into positions that are well established, trenches that are more or less well built, varying a good deal in certain sectors; in some parts of the front that we are holding now the battalion-aid posts are very close to the line; they can be usually evacuated by ambulances, especially at night; the dugouts are very excellently built, suggesting that they were going to be used for a generation. This may change entirely, as it has changed in Flanders and in the Somme in the last six weeks. Things that were well established, casualty clearing stations that were operating were lost, battalion-aid posts, advance dressing station were given over; an advance of 30 or 40 miles made, everything was changed; the fighting as it exists to-day is on a different basis entirely from that we are talking about here, which applied to trench routine, not to fighting in the open, which is not at all the kind of thing that we have become more or less used to in the last three years of war. At the present time our divisions that are serving in sectors of the French Army are met with the conditions of trench warfare and we have to carry on in that way. There have been engagements that have tested this system that we are trying to develop. In the 42d Division, on the 5th of March, the enemy commenced a violent bombardment of the position held by the 1st Battalion of the 168th Infantry, at 4.30 a. m. and continued it until 6.20 a. m. The evacuation of wounded through the battalion-aid station commenced at 7.30 a. m. All the severely wounded, except one man, had passed through the battalion-aid post by 10.30 a. m. Patients requiring the Thomas leg splint had had the splints applied were found by the litter bearers. None of them were moved before the splint was applied. Lieut. Charles H. Moore, M. R. C. personally examined these patients as they passed through the aid station and found that the splints were properly applied, requiring only slight adjustment. All splints were applied within one-half hour after the action ceased and within three hours after the first wound was received. Because of the intensity of the fire it was inadvisable to attempt to move the wounded until the artillery action had ceased. In that particular action the bombardment was not followed by an attack. Usually a shelling of that kind gives every indication that immediately following it will be an attack, but in this case it was simply a shelling which he gave this particular battalion. The wounded men as they came back to the hospital were in very good condition. Their average time in reaching the hospital was less than six hours, which is very creditable.

On April 12, in the 26th Division, in a battalion aid post back of the 104th Infantry, located in the A—— Woods, I observed the evacuation myself. The wounded reached this battalion aid station in the morning at about 10.20 a. m.—some 25 in number. These men had endured heavy shelling and encountered a raid put over in force by the enemy. It was a hand-grenade party after the Germans got over. This had been going on from sometime early in the morning. Many of the wounds sustained were from hand grenades and 15 of them were slight in character—that is, wounds of the soft parts. There were 10 seriously wounded men and 2 men died in the battalion aid post. The character of splinting and transportation given these men was, under the circumstances, beyond criticism. Captain Dudley was the battalion surgeon at this post. An unfortunate thing happened to his

supplies. He had his supplies in a cart—they had just moved into the position the day before—which came up from the ambulance dressing station, about 1,800 yards down the road. The cart was placed in front of the battalion aid station, with the splints and cotton, etc., on it; a 77 shell scored a direct hit on the cart, so there were no splints or dressings or anything left. Captain Dudley had to send back for more, which came up promptly enough, and he got them forward into the advance post in the line. There was considerable shelling of this battalion aid post, some of the shells being gas shells. In spite of this, an additional supply was brought forward from the ambulance dressing station and sent forward to the advance posts. As the men came back they were given hot drinks and were wrapped in warm, dry blankets, notwithstanding the severity of the artillery fire. The wounded were evacuated to No. 1 Evacuation Hospital at S——, where they arrived in good condition considering the long ambulance journey. There is a battalion aid post in this town and up on this hill is another battalion aid post. The battalion aid post, being on a hill, was a very good mark. An unfortunate thing happened. The battalion's supply of rockets and trench-signal stuff was in a small shed and a shell hit this shed and the whole outfit went off—red fire and all kinds of things. Of course, that gave the German artillery a very good mark to shoot at; so the rest of the time they shelled the battalion aid post. It is a very good post, however; quite well protected. The wounded had to come down this road by litter. An ambulance could just as well have taken a chance and gone up there, and the ambulances did go up afterward. Ambulances should take the chance, I believe, on a road of that kind, and in all engagements they have done very well with this dangerous task.

On April 20 to 21, in the 26th Division, an action began at 4 a. m. Cases began to arrive at Field Hospital 102 at about 8 a. m. on April 20. This hospital is at A——. Gas cases were treated here at 102; all wounded men were evacuated to Evacuation Hospital No. 1 directly. There passed through 102 the following:

8 a. m. April 20 to 8 a. m. April 21:

Wounded.....	172
Gassed.....	46
Sick.....	36
Total.....	<u>254</u>

8 a. m. April 21 to 8 a. m. April 22:

Wounded.....	45
Gassed.....	60
Sick.....	23
Total.....	<u>128</u>

The wounded arrived in from one to eight hours after receiving their wounds. As the battalion aid stations, of which there were two, were in the hands of the enemy for a time and were the scene of hand-to-hand fighting, and as the ambulance dressing station at X—— and its lines of evacuation were under constant and severe shell fire from 4 a. m. of the 20th until 4 a. m. of the 21st, this was excellent work in getting them out. Only the organization work on the part of ambulances and stretcher bearers made this possible. Ambulances ran through this shell fire and brought in wounded. Lieutenant Abbott was with the ambulance dressing station at M——, which was struck 12 times by direct hits. Those of you who have been to that station know that it is in a house at the corner of the road, a perfect mark for artillery fire. It had a Red Cross flag on it and a German aviator flew low enough to shoot the Red Cross off the hospital with his machine gun, and they got 12 direct hits on this house. The dugout wasn't completed and they had a close call. They were all gassed. The wounded who came in there, in spite of the shelling, were in very good condition so far as dressings and splints were concerned. This station was abandoned at midnight on April 20. All the officers and 15 men of the Medical Corps were gassed, but none seriously. Capt. Frank Dickson saw all cases which came through 102 from 8 a. m. 20th to 8 a. m. 21st. Only a few cases received any additional treatment beyond what they had already received, except to be given hot drinks and warm food. Only one splint was changed, and that was a compound fracture of the tibia, which was splinted, but not sufficiently. Only a very few

cases came in without having received antitetanic serum. The work along this line was excellent. The fact that these men got A. T. S. under these conditions, with the advance aid post out of commission, ambulance dressing station shelled directly, yet when they reached the field hospital at M—— they had antitetanic serum, I think is very creditable.

Three cases died at Field Hospital 102. These men arrived almost moribund.

On April 21 a number of cases came in who had been wounded for a number of hours. This delay in evacuation was due to the fact that many men were wounded in isolated places. Evacuation by ambulance was carried on as far forward as S——, which was partly in the hands of the enemy. They got into one end of the town in great strength. The number of Germans that came over has been stated at 2,000. They did come over in great force; they drove our men from the trench and back into S——. They fought all that day in the streets with hand grenades and with rifles. The ambulances ran up to this town and were considerably shelled. The evacuation from Field Hospital 102 to Evacuation Hospital No. 1 was carried out in good order. At the evacuation hospital it was stated the patients arrived in good condition.

Details of evacuation methods.—We have been trying out various types of trench litters, as you know the necessity for some type of trench litter that is light and durable and can be adjusted quickly is mandatory in this type of trench warfare. The pole and stick arrangement that the French use has had ill success with our troops. The poles usually get broken. The Butler trench litter is made of wood, having the disadvantage of not being very durable. Trench litters, of course, get wet, and a wooden litter covered with a veneer is very apt to warp and go to pieces quickly. We have had reports from the division surgeon on this matter and they have reported that this type of litter, which was designed by Major Garcia, regimental surgeon of the 16th Infantry, has worked out the best. It is durable and is not easily broken. It will stand water and mud; it is light, which is, perhaps, its chief advantage. The straps and tapes should be black in color, or brown. In the illumination of a star shell white cloth shows up very brightly. Perhaps one of the class will volunteer to get on the litter? [One does and the operation of the litter is then practically demonstrated.]

That is all that is necessary to fasten the man on the litter. It gives pretty good support for injuries of the arms and legs just as it stands. If some of you will help me lift this man. Just put that end on the floor. [Stands patient up.] I don't think anyone could complain of the pressure in the crotch. Does that hurt?

Answer. Not at all.

They are as comfortable as it is possible to be, I believe. It can be carried sideways, face down, or slid around a corner, without much disturbance to the wounded man. Does your weight seem to rest on your legs or in the crotch?

Answer. About equal.

The question of handles. That's a difficulty. The man who carries at this end has the weight forward on his shoulders, and they complain considerably of that. He gets tired carrying a heavy man, because the weight breaks forward on his shoulders. We are trying to obviate that and the last ones that are coming out carry a strap that a man can throw over his shoulders and get the weight on his back, and two rods for the hands at each end.

Some one has asked about putting feet on the litter. We have found that anything projecting from the side of the litter makes it difficult. As you perhaps know, some of these trenches have trench wattling, and anything sticking out will catch in this as you try to go around a corner; and then the walls of the trench are very apt to catch against the feet or anything sticking out on a litter, so it is much better not to have anything that protrudes from the litter.

There are various modifications of this thing that will come along as we desire them. We have already found that we will have to put handles on it. It is very difficult for the stretcher bearers. The man at the feet does pretty well, but the man at the head has a considerable load to carry. But, on the whole, I think it has been found to be a very satisfactory type of litter. Its predecessor in the litter field is the Stokes litter used in the Navy. The credit, I believe, is due to Major Garcia for designing this litter—Major Garcia, U. S. M. C., of the 16th Infantry. It is called the "trench litter—Garcia type," or the snowshoe type of trench litter."

Question. Could you clamp folding handles on the end?

Answer. Yes; that could be done, but it hasn't been done as yet. We are trying the canvas loops now. The question of labor and complication mechanically is very important. Anything that's simple—that can be made by a fairly unskilled person, as it stands there. Now the minute you add feet to it, handles to it, it becomes a thing requiring skill to make; and this thing as it stands costs about 120 francs per litter, and so anything added to it runs up the expense tremendously and makes it difficult to make them. We have tried quite a few now in the divisions engaged and, though it isn't ideal in all conditions, it is satisfactory for most.

Another point in battalion work. In the battalion aid posts and ambulance dressing stations in the three divisions that we now have in this locality, this little card has been placed regarding the prevention and early treatment of wound shock. This is a compilation of things that you all know so much about that it is not worth while to dwell on it. We have had criticism about blankets—the folding of blankets. I think most of you men have heard of that. These men should have the blankets folded properly in the methods that you know so well, and the battalion surgeon is the man to enforce this thing. He can't do it himself; he can't give hot drinks himself; he is too busy, and he has got to instruct the men who are there with him, the Medical Corps men, in doing these details. The question of hot drinks can be arranged; hot drinks and cigarettes. Most of the wounded men like to smoke a cigarette when they get to the battalion aid post. They are craving a cigarette at that time, and it is a good idea to give it to them. Somebody has to give the cigarette to the wounded man and light it for him, also give him his hot drink, and it is well, I think, in times of stress to detail a man to that particular duty. In Field Hospital 102, when the wounded came through the other day, the commanding officer made one Medical Corps man responsible for hot drinks and cigarettes; and keeping the hot water supply on hand. That was his duty. It was put into his hands to see that every wounded man who wanted it got a cigarette and that it was lighted; that every wounded man got a hot drink immediately on his arrival. Somebody else was placed on the question of stoves and heating, by putting the Primus stove underneath the man, with the blankets folded down on the side of the stretcher so he has four folds below and four folds above. This card pasted on the wall is not for the instruction of the battalion surgeon, or for the ambulance surgeon, but for the instruction of the enlisted personnel in these two places. They see it and it acts as a constant reminder to them of the things that they should know about. It says here: "Consider the general condition of the wounded man first and treat his wounds second. Keep one dry stretcher with three dry blankets always in readiness." Give the wounded man a hot drink with a tablespoonful of sodium bicarbonate dissolved in it as soon as he arrives. Sodium bicarbonate is advised by Major Cannon; if we were to go into it, it would bring us to the question of whether the sodium bicarbonate raises the alkalinity of the blood or does not, and I don't think that concerns us particularly. Major Cannon found in his experiments on the British front that sodium bicarbonate was a practical thing to give the wounded and seemed to have a beneficial effect on the acidosis of shock. He regards shock as being an acidosis and especially where muscles are lacerated and torn. The acid is thrown into the circulation from muscular activity and sodium bicarbonate is a possible thing to give. One thing is, it is a nauseous sort of drink in tepid water, and perhaps something else in the drink would help. Put it in a weak tea, if you have tea, or some other flavoring. Sodium bicarbonate we believe should be given.

When the wounded man is well warmed and quieted, dress the wounds and apply splints properly for the ambulance trip. The ambulances carry hot-water bottles. Turn the blanket ends over so he is well tucked in. Finally, just before the patient is sent out give him another hot drink. Above all, antitetanic serum should be administered in the battalion aid post.

An attitude of cheerfulness and encouragement is of great importance. As I have already seen it in my limited experience, I think that the battalion surgeon has a wonderful opportunity to buck these fellows up a bit. They have had a very hard trip. They have a fractured bone, a lot of them have been fighting and they are still angry, and they all are stirred up. I know after this A—— Woods affair 10 days ago, when they brought the wounded in they brought in at the same time into the open space in front of the battalion aid station 21 German prisoners. In order to show you the state of mind these wounded

men were in, I say you never heard such cursing in your life as came out of the battalion aid post from our wounded fellows. One fellow had lost a foot and had a compound fracture of the tibia on the other side, but nevertheless his only desire was to get up off the stretchers and go after these Germans whom he saw crowding toward the door of the dressing station because the shells were falling pretty close. The battalion surgeon has a wonderful opportunity to tell them they are "all right," that they have been brave fellows and got away with it fine, and all that sort of thing; and it helps them a lot. And a lot of shock, I am quite convinced, is associated with the extreme mental disturbance that these men are in. Of course, that is very apt to become fanciful if you go too far with it, but it is true, practically. They need to be encouraged and quieted, and this is one of the difficult duties of the battalion surgeon.

The question of morphine. I think that the men who have studied the use of morphine in these conditions feel that too much morphia is harmful. But I believe that each man ought to have a quarter of a grain. I think the tendency is to give half a grain. I believe that is too much as a rule. Every one of them ought to have a hot drink or two, and preferably a lot of sugar in one. In passing, I don't believe that a battalion surgeon ought to go beyond his battalion aid post. He is too valuable to go forward. He is needed as a directing agent in the post. His men that he sends up can get the wounded back all right. They have been instructed; they have the courage; and they will do it. The battalion surgeon must stay in his post and carry on there. That's his place. He has to check the splinting and also keep up his supplies and make the difficult decision as to when a wounded man should be sent back from his post.

Now, there are certain variations in our splints from the type of splints that are used in other armies. We have a splint which has worked out admirably—the Blake-Keller modification of the Thomas splint. Then there are these dressing packets in three sizes. The red one is the small one; the white, the medium size; and the blue, the large size. Everybody wants the big one. An American characteristic.

Question. What do you think ought to be the relation of the issue?

Answer. This packet here (red) will dress almost any wound that comes back. The middle size will dress a very large wound; the blue is rarely needed. The bandages in these packets are bias-cut bandages, a very valuable thing, because such a bandage will lie on any surface and doesn't require any fancy bandaging. It will stick to a knee joint or elbow joint. We issue them 6 red, 3 white, and 1 blue, as the requisitions come in. The requisitions usually ask for the large packets. The medical supply depot exhausted itself of large packets and only small ones were left. There is no reason for this. It is better to use the small ones. They are much easier to carry, and they are perfectly adequate for most of the wounds.

Before we close, there are one or two things that I would like to speak of briefly. The wire gauze put on a Thomas splint makes a very good sling, and it can be quickly done. This is much quicker than tying of triangular bandages or using safety pins. The leg can rest in that perfectly well. Most of the men are doing it that way.

Another way is to have the bandages pinned or tied along the side bar of the splint. In the 42d Division they are doing this. In quiet times they pin a lot of slings along down the side bar. Always pin them on the short rod.

Ladder splint: This is the most important splinting material we have outside the Thomas splint. With this thing you can make a very good box splint for injuries of the soft parts, or injuries of the knee not involving fracture. Wherever there is a fracture and it is possible to get at it, it is necessary to put on traction. It can be applied to fractures very low down in the tibia. The easiest thing to apply and the best traction device I have seen is that of Poliquen. Just two throws around the ankle. If the fracture is low down in the tibia that's an excellent way of putting on traction. The various ties, the clove hitch, and that sort of thing, you are familiar with.

Finally, the question of the tourniquet comes up. As I have gone around I have had a lot of questions asked me about the use of the tourniquet. It is the most dangerous thing we have in our possession, I believe, and also it is a very necessary thing. A battalion surgeon has got to use his judgment promptly as to how long he is going to hold a man at the bat-

talion post. The wounded man should not be started back before he makes a turn on his shock. If he is going to die, if it is impossible to save his life, he had better die at the battalion aid post than in the evacuation hospital or in the ambulance. Those of you who are battalion surgeons should not let the fear of criticism get the better of your judgment. Of course, everybody wants to get the wounded man back as soon as possible, but he must be held until he has made the turn; that is, until he is warm and quiet and able to travel. He can then go back and arrive in condition to be operated upon; otherwise he has to be treated for a long time before he can be operated upon, or he dies. The same thing applies to a tourniquet. I don't believe a tourniquet is very frequently necessary in these wounds. They are usually the kind of wound that doesn't require much, but when it is necessary it is very necessary, and that's where the battalion surgeon has to use his judgment. I will say that no man ought ever to leave a battalion aid post with a tourniquet on. Don't send a man back in an ambulance with a tourniquet on. If he is bleeding to the extent that he has to have a tourniquet, you had better hold him a while.

Question. How about tying the arteries?

Answer. I don't think that should be done either. There is no provision for it in any battalion aid post I have ever seen. Of course, if a man has a big artery spurting and you can pick it up, it should be tied—but that's rarely the case.

There are two or three things that have been lately developed that I would like to show you. This sort of package can be made with 2 Thomas leg splints, 1 Thomas arm splint, and 1 Cabot splint, 3 or 4 dressing packets, and some triangular slings; this can be carried into the trench by one of the enlisted men who serves as a Medical Corps man with the battalion. It is rather compact and can be carried along with him when he goes in. In the battalion aid post a similar supply can be kept to send up at any time that the advanced supply is exhausted. These buckles and straps go with it. I think they are very useful. The buckle and strap can be used to strap on a splint, it can be put over the dressings that are applied inside the traction splint so as to hold them in place. It is much quicker than bandaging, and there are plenty of these available. This splint rest goes on the Thomas splint, can be put on the Thomas splint at the battalion aid post so that if a man is taken down from the bar on the litter, traction can be kept up. The splint rest was modeled after the British device. The British device had the two loops running the same way, so that when you put it on the splint you could push the splint out; this is made—it springs out that way and thus you can not push it out. By putting this loop that way it holds. It will go on any part of the splint.

This splint, the Cabot posterior wire, we found much more useful than we thought at first it would be. It is a very simple thing to make and a very useful splint. Before it is covered with the bandage it is well to spread the splint, stretch it, and then pull your bandage in so that it comes to look like that, and then the bandage won't slip down. In slack times the men in the battalion aid post can fix them up. This splint is very useful in certain soft part wounds of the lower extremity. It is much more comfortable for the man. He gets back in better condition.

We had recommended the use of Thomas splints for transportation and we found in the 26th Division last winter, in going over these splints, that you couldn't get a man in a Ford ambulance with a Thomas splint on him, and as most of the divisions were supplied with Ford ambulances there arose quite an obstacle. The stretcher goes into the Ford ambulance and the tailboard comes flush with the stretcher, and a Thomas splint, even on a short man, goes out beyond the end of the canvas so you couldn't close the tail gate on the ambulance, and this litter bar was got out to meet that necessity. The litter bar goes on an ordinary type of our stretcher; it is a little bit difficult to get on I find. One man has to hold the stretcher up and another slips it over. It goes above the handles. The bar goes toward the head of the patient, just above the two stirrups or feet, toward the patient's head. Of course, the elbows on the stretcher have to be fully extended, or else the stretcher will collapse. The screw is tightened up and brought very tight, and thus the bar will stay in position. We are using this bar on the G. M. C. ambulance because it is better to have the thigh flexed with a fracture of the femur than to have it out flat. The wounded man will ride more comfortably. The ambulance companies have them, the field hospitals have them, evacua-

tion hospitals have them, and the director of ambulance service has to be constantly on the lookout to see that exchanges are made and the supply kept up. You see, with a large number of wounded going back all the splints would be in the evacuation hospitals in a short space of time, but the evacuation hospitals that we have started and are starting have a sufficient supply of all these things to give the ambulance driver a stretcher, a Thomas splint, and the whole outfit when he leaves the hospital, in exchange for what he has left. The Ford ambulances in this division carry one Thomas leg splint, one Thomas arm splint, and wire ladder splints constantly in the ambulance, so that the driver always has a certain amount of supplies and splints in case of accident. For instance, a battalion aid post or an ambulance dressing station falling into the hands of the enemy might cause us to lose all the supplies we have there and we have got to have something in the ambulance to meet the emergency when it arises. We look to the battalion surgeon and the battalion aid post as factors of great importance in the care of the wounded. The regimental surgeon comes next; his duties, as you well know, are multiple and very exacting. The chief of ambulance companies has a lot of responsibility on his shoulders; and it is these three persons—these three medical officers—that can help most by cooperating with each other and with the medical supply officer of the division in keeping up a constant flow of these supplies from rear to front to counteract the flow from front to rear and in getting men through this zone of shock where their condition is most precarious. Most of the men who die, die in this zone, and it is here that the highest degree of surgical judgment and skill can be put into force and made effective.

Another thing to the men who are working in this zone: Operating is what most of us think of as surgery. Operating—a good operation—that's the end of it so far as the surgeon is concerned. But that isn't all of surgery. The surgical activity in the advance zone is to my mind of equally great importance. The question of skill and judgment in handling men, in handling the wounded, are greater than those that the men in the evacuation hospitals have to meet. There, things become more routinized. They have nurses to help them; more surgical personnel to help them; they aren't on their resources as men nearly half so much; and, in closing, I want to say that the battalion surgeons that we have had so far, with very few exceptions, have proved to be perfectly trustworthy and very capable, and have gotten away with difficult jobs in a very remarkable way. Two or three failures in application of splints have occurred. One of them I looked into in the 1st Division. The medical officer was killed in his dugout. A patient came out of there with no splint applied. Another instance was where a man shot himself—a self-inflicted wound—through the thigh and fractured his femur; and the battalion surgeon in this particular battalion, when this man was brought in and the story was told about shooting himself intentionally, he told him to go back without any splint; that he wouldn't splint him; wouldn't have a damn thing to do with him. You can see his point of view very clearly, but, of course, that doesn't look very well from a medical standpoint. We have had one or two other instances where men have come back without splints due to conditions of stress and lack of supplies, but in every instance, so far as I know, there has been a perfectly adequate explanation. It hasn't been due to carelessness or excitement or lack of the proper kind of courage in carrying out a very difficult piece of surgical work.

Army Sanitary School No. 87.

H. O. E. ———, MAY 6

There are 3,275 beds, plus 900 for *éclopés*. According to the commanding officer of the hospital, an *éclopé* is a man who is incapacitated by some cause other than a wound received in battle, generally he is just a little sick. No man wounded in combat is referred to as an *éclopé*.

The triage of Bouleuse had four Adrienne barracks at the entrance to the hospital, with a large driveway leading to them; one for lying patients, one for sitting, and one for sick. The fourth one (*magazin des armes*) is to keep the men's equipment and clothing in. We were much interested here in the booking. If a man has been evacuated from an ambulance, he brings a slip which practically corresponds to the field medical card of the English, and which the French call a "*billet de hospitalization*." If he comes from a regimental or battalion aid station he brings only a diagnosis tag, called a "*fiche*." The triage consists in merely sorting out these patients from the diagnosis on the tag and the general appearance of the man. At

present there is only one triage running, which takes everybody, because there are only a few patients. In this triage the man is booked by a sergeant; there is also an emergency room for anything that might happen while the man is being held there. There is here no provision for dressing, nor is there any attempt at same; only the records are made here.

The necessary facts concerning the man are transcribed into a book called "carnet de passage," each page of which consists of 10 slips for inscriptions for 10 men, which are torn off and distributed as described further; the paper is perforated for this purpose. These inscriptions are made in triplicate by carbon paper, and one detached slip accompanies the man, one goes to the office of the H. O. E. to be kept in the archives, and the last is sent to the War Office. His hospital number is put on this carnet slip, and forthwith this number is affixed to him. In addition, a whole page is taken up in giving him a register of entrance, which is also made in triplicate for each man in a separate book. One of these is torn out and sent to the man's regiment immediately, one to the surgeon general's office in Paris, and one remains on file. This triage, therefore, is absolutely nothing but booking, and the real triage is done on the operating table. Nevertheless, the patients are sorted according to the diagnoses they bring. Antitetanic serum is administered in the emergency room of the triage if the man has not already had it. There is also a buffet here for hot drinks and there are litters set on trestles for the men unable to sit up while the booking is taking place. I am told that only about $1\frac{1}{2}$ per cent of the patients received here had not received antitetanic serum before arriving. The personnel of this triage is 1 sergeant, 2 secretaries who are sergeants, and 4 litter bearers. There are two sets of books for the carnet de passage and the register, one for even numbers and one for odd. This is done to allow the booking to proceed more rapidly. A card index is kept at the office of the evacuation department also, and a numerical list of the patients admitted per day. The card index consists simply of squares of paper of the same size in a box and they contain the names, arranged alphabetically, with diagnosis, etc., so their histories may be used by the evacuation bureau, which is the other end of the office work—that is to say, where the man is booked out. It has 1 military surgeon, 1 administrative officer, and 2 teams, each of 1 sergeant and 4 men—1 for day and 1 for night duty. They make a check of all the patients in the hospital at 8 a. m., at midday, and at 6 p. m., and get the number present, the number of evacuable, those not possible to evacuate, and the number of empty beds. The evacuable are further classified as to wounded to be transported recumbent and those to be transported sitting. In times of activity and in preparation for a big offensive all are evacuated that can be. In times of calm they keep all they can. Upon the information being obtained by this checking, a telegram is duly prepared and sent; one to the responsible officer of the general staff, fourth bureau, at headquarters, and a duplicate to the regulating train officer (the commissaire regulateur), giving the number to be evacuated, lying and sitting, etc. All this is placed on a blackboard and gives the actual state of the hospital in the last few hours. This blackboard is for the purpose of helping in the make-up of trains. Only those who can not recover in four weeks are sent back. Those sent to the zone of the interior may get from 10 days to a month's leave of absence, and at the end of their leave they report to the base division for instructions. The headings on the blackboard are as follows:

ZIELA—Zone, interior, distant, lying, and sitting (interieur, éloigné, legers, assis).

ZIELC—Same, except last letter, which means couchés (lying).

ZIESA—Same as previous one, except last two letters, which mean serious, sitting (serieux, assis).

ZIESC—Same as the last, except the last letter, which means lying (couchés).

ZIRA—Zone, interior, near by, sitting (zone, interieur, rapproché, assis).

ZIRC—Same as last, save last letter, meaning lying (couchés).

Following this is a column for "TB," for cured "gueris," for seabies ("galeux"), éclopés, and "on leave of absence."

These last, beginning with TB, are generally evacuated by means of motor ambulances. At the end of all is a résumé—the total number of evacuable and nonevacuable, grouped according to whether French, allied, or prisoners of war.

From all of this graphic statement the entraining officer makes up his train. He gets from the bureau of admission the man's slip (carnet de passage), and pastes it, with all others

to be evacuated, in a little book with a folder, to hand to the commander of the hospital train, who receipts for it. Thus is a full description of all patients who will go on the train rapidly provided. He, himself, does not know where his patients are going, but when the train commander distributes them at their destinations he enters record thereof on each carnet de passage in the folder given him, and sends back this folder with the destination entered, to the officer in charge of evacuation at the H. O. E., with his indorsement. Thus the completed record returns to the H. O. E., generally in a week or 10 days, and remains in the archives of the hospital. In this way the details of the whereabouts of patients, in case they are requested by relatives or by the War Department, is on hand at the H. O. E. from which he was evacuated.

It takes about a half hour to load the sitting patients on trains, which hold 150 to 200; one and a half hours for lying patients. Before the patients leave the H. O. E. the evacuating officer places in an envelope, properly inscribed, larger but similar to envelope bearing our field medical card, the "billet de hospitalization," in addition to any clinical notes from the ward surgeon, giving details concerning the case for the benefit of the next medical officer to receive him. This includes drawings, X-ray pictures, etc., as well as recommendations for treatment, and contains all that has happened to the man before he came to the H. O. E. and during his stay there. The patients are sent for, from the wards in which they are, one hour before train time and are taken to the train shed, all ready. Walks are laid down from the evacuating wards near by to this train shed.

In this H. O. E. there are 800 beds for hospitalization and the nonevacuable. There are also 800 beds for those to be evacuated sitting, 775 for those to be evacuated lying, and 900 for the *éclopés*, giving a total capacity of 3,275. There are two Bessonneau hangars near the train shed which take 150 lying and 300 sitting. Actually there is but one in use holding 84 beds, which makes a beautiful ward, with enameled iron bunks and sanded floor. The other hangar is used as a theater, temporarily. They are models of cleanliness and order. There is a group of barracks for the *éclopés*. The Bessonneau hangar receives the lying cases from the surgical wards to be evacuated.

There is an ophthalmologic center here which is very complete. Its team was at the front on the ——— and it was closed.

The medical barracks are all together and under the supervision of M. Guilan. In one of these barracks are placed medical cases to be evacuated, and this is near the train shed. At present these wards have very few cases and were chiefly filled with severe cases of bronchitis. One was devoted entirely to Italians, a number of which are working here on roads.

There is a new center here just opened for the sterilization of dressings, etc., and their preparation. Here are two large horse-drawn autoclaves, weighing about 12,000 kilos, marked "Geneste-Hercher." They are more complete than the Thresh apparatus and were originally intended to disinfect clothing. On entering the plant one finds a window leading out from the distributing storeroom which is filled with standard tins of dressings, and there is a large storeroom for raw stuff, a room for the making up of dressings, and a room for the separate sterilization of hypodermics, which are all of glass. In the room for the making up of dressings was a long table, slashed where the gauze was cut into short pieces, by a very sharp saber. Six inches of thickness could be cut at one slash.

The standard container for gauze was the "gamelle." It is a deep soup tureen with a tin top and handles holding about a pint, and is part of the personal equipment of every soldier. Here these are also used for sterilizing rubber gloves, which were wrapped in gauze, the fingers being separated by strips of gauze. These gamelles for gloves also contain two hand towels, and are sterilized at 110° to 115° C. for 40 minutes. All cotton material was sterilized for two hours at 150° C. The containers for towels, cotton, etc., are biscuit tins. There was also here a glove and rubber bag repair shop, the repairing being done with bits of rubber cut from old rubber goods and bicycle tire glue.

In the interior of the packets of dressings there is placed a fine capillary glass tube containing sulphur and a small quantity of methylene blue. This fuses and gives a beautiful ultramarine blue at 140° C. They have a manometer attached to the steam autoclave which registers also the variations in temperature within a cylinder run by clockwork.

At this hospital they depend on sulphur fumes to exterminate lice and their eggs, but the clothing of cases suffering from scabies is put through the steam sterilizer.

FURTHER NOTES ON THIS HOSPITAL, FURNISHED BY ITS COMMANDING OFFICER

The triage of the medical cases divides all sick admitted into a group for evacuation to be treated until the leaving of the train, and into a second group to remain at the hospital. Surgical triage is made as follows: All cases are sent to Surgical Group 15, Professor Lemaitre, where he retains all for primitive suture, where this can be done, and sends to Group 10 only wounds of the skull, thorax, and abdomen (for M. Roux-Berger) and wounds of the articulations (M. Leriche). In a period of great activity triage may be made entirely administrative, on the diagnosis tag, and the wounded will be distributed as follows: Group 70, slightly wounded, capable of being evacuated immediately; Group 40, moderately wounded, sitting and lying; Groups 15 and 10, nontransportable wounded, for sutures of the soft parts which require them to remain in the hospital for at least five days before being evacuated. The individual register for each man referred to in the body of the description of this hospital is not made out except for men who remain more than 24 hours in the hospital. The card index ought to contain, under each name, the hospital ward he occupies, the date of evacuation, and the formation where he will have been hospitalized after leaving the H. O. E. For this purpose a blotter should be kept from day to day at the triage registering all admissions. The bureau of evacuation contains all the data concerning the discharge of patients:

- (1). Men rejoining their corps.
- (2). Contagious cases or cases requiring specialist treatment evacuated by motor ambulance on certain neighboring formations.
- (3) Men departing on leave of absence.
- (4) Men leaving by sanitary trains.

At the end of each day the bureau of admissions transmits to the bureau of evacuation the blotter of the carnets de passage of those entering, papers which are kept until the patient leaves the hospital. As soon as a man is marked as evacuable the retained slips of the carnet de passage, bearing a number coinciding with the number borne on the billet d'hospitalization, are pasted on the folder made up for turning over to the commander of the train or auto, this folder being prepared in advance according to the category of the trains. A list of patients designated in each service for evacuation by the ward surgeon is made up each day at 8, 12, and 6. A full statement is made for each ward of the number of occupied beds, number evacuable by train, sitting or lying, or by motor ambulance, the nonevacuable and the number of beds which are empty. At the same time they take up the envelope from those to be evacuated in which there is the billet d'hospitalization.

In normal times the following are evacuated by train:

- (1) The sick and wounded transportable, which can be cured in less than four weeks; they are sent to the zone of the army.
- (2) The sick and wounded that need more than four weeks for their cure; these are sent to the zone of the interior.
- (3) Those evacuated to the zone of the army to rejoin their corps directly after leave of 10 days. Those evacuated to the zone of the interior after cure are sent to the corps depot.

In times of exceptional activity all are evacuated into the zone of the interior, except those that can be cured in 10 days or those who are intransportable, who have contagious diseases, who have venereal diseases, or who have seabies. As this is a time of exceptional activity, this is the present régime.

Every day at 1 p. m. a telegram is sent to the commissaire regulateur and the fourth bureau of the general staff of the army, advising them of the number to be evacuated, according to categories elsewhere stated.

The commanding officer of the H. O. E. now requests a train of the commissaire regulateur by wire as follows:

Send a train to-morrow. Station of loading.....

ZIEL { sitting. } Load.....hour. Depart.....hour.
 { lying. }

When this is sent, the bureau of evacuation advises the wards, the kitchens if there is necessity for a meal before leaving, and the sergeant in charge of the litter bearers who are to carry the patients aboard the train. The wards' sergeant in charge of litter bearers must

also be given a list of the patients he is to get out of each ward. The folder upon which the train has been made up is verified once more and signed by the medical officer and administrative officer of the bureau for evacuation. There is required for each patient a certificate that the man has not drawn any pay at the hospital, or one should state if he has done so. The men to be evacuated are assembled in the special barracks for evacuation, near the depot, 15 minutes before loading. They call the roll and each name is checked off, the folder made up for the train commander, and then each patient is inspected to see that he has the envelope bearing his particulars tied to his button. When the loading is finished the medical officer of the sanitary train checks up his list with that which remains at the H. O. E. and must telephone to the fourth bureau of the army the number of patients he is evacuating. He can give a receipt to the H. O. E. of the number of patients evacuated. This receipt is required for all persons under the authority of a court-martial.

The cases that go to the zone of the army are reissued their equipment, but those that are Z. I. cases have their pack broken up and sent to the different departments which issued it. These take no equipment with them when they leave the H. O. E. for the interior. The pack store is open day and night. Litters brought by ambulances are always replaced here. It is forbidden to remove a man from a litter until he reaches a hospital bed. This hospital can evacuate 3,000 cases a day. There are three trains a day, each accommodating 150 to 200 cases. They load the train from the rear forward.

Army Sanitary School No. 88.

STATEMENT OF COMMANDING OFFICER OF ARMY SANITARY SCHOOL (COL. BAILEY K. ASHFORD) TO ARMY SANITATION CLASS, AT OFFICERS' LIBRARY H. O. E., JANUARY 27, 1918

The class was divided into two groups and one-half was invited to visit ———. We proceeded by train for 5 miles, by horse ambulance for another 5 miles, and from there we walked in. A portion of the city is totally destroyed, a portion bears evidence of heavy bombardment, and still another portion bears very little trace of shell fire; but we were told that most of the houses were damaged even though their exteriors presented the aspect of being in good condition.

We visited here a hospital which was, in fact, a field ambulance, receiving cases from sector guarding ———. It was situated in the municipal hospital of the city which apparently was intact, but on entering we saw evidence of some bombardment. In spite of the handsome building, and good accommodations, only the cellar was considered safe to use for patients. This cellar was very well lighted by electricity furnished by the radiologic outfit of a *groupe complémentaire de chirurgie*. Artificial ventilation was secured by aspiration twice a day.

Nearly all injured in this sector are brought to this hospital before being transported farther back. It was in an out-of-the-way locality. Despite the fact that only the severely wounded, abdominal cases and certain cases of shock and wounds of the chest, were kept there, there were accommodations for 60 patients. An oven stood in the center of the receiving room, which, besides heating sandbags and blankets for patients, contained a couple of compartments in which a whole litter could be placed, but leaving the man's head outside.

This was a typical "ambulance de triage." I do not understand why patients should be taken there before being sent to the rear, as it was only 2 km. from the line, was unsafe, hard to get to, and was out of the way. There was no special surgical team at this ambulance, which was rather frequently changed, nor could any special purpose be served by having an advanced surgical hospital at that point. It was very clean and very well administered, but the cave itself was only splinter proof, and not at all protected from shells, as any direct hit would pierce the cellar. This really happened in a cellar of this very hospital near by; at that time, fortunately, not occupied.

Army Sanitary School No. 89.

SUMMARY OF A TRIP THROUGH ADVANCE ZONE ORGANIZATIONS MADE TO THE STUDENTS, SECOND SESSION ARMY SANITARY SCHOOL, AFTER A VISIT TO THE TRENCHES, JANUARY 28, 1918

The portion of the class which did not go out to-day will go out to-morrow. There will be two groups and we will assemble at 6.30. We will have coffee promptly at 6.15. Remember what I said the other night about overcoats. You had better take your overcoats

and keep them on while you are riding, but when you do any walking leave your overcoats in the ambulance. You will get overheated and it is well not to wear your overcoats in the trenches. The same preparation in overshoes and boots.

As to our trip to-day, I am going to tell you something about it for the chief reason that I think these things ought to be committed to paper before the memory becomes dumb, while it is still fresh in the mind, and, secondly, because the class that's going there to-morrow will have some other things to see, and if they have an idea of what they are to see they will be able to profit the more. I am going to talk from memory and I will ask Major Rushford to mention any points that I leave out.

We left this morning in automobile at 6.30 to study the organization of the sector nearest ——. We met the division surgeon at X——, and he explained to us that he was going to show up a typical regimental aid post, two battalion postes de secours, two special surgical hospitals, two advance posts and the groupe de brancardiers divisionnaire; he, himself, had his headquarters at the central post of the G. B. D. The very first thing we found there was a matter of intense interest to me, as I didn't know that the French had done it: They are copying the English in dividing this front up into sanitary sections which are permanent and whose personnel does not change. No matter how many divisions come in and go out, it is always the same. Each section consists of 1 surgeon, 1 pharmacist, 1 corporal, and 15 men, some of whom are carpenters, others tinsmiths, others workers in iron, etc. They build sanitary appliances, latrines, bathhouses, etc., seeking assistance from the engineers when the work becomes too heavy. They really had a very good installation at this G. B. D. We noticed there, among other things, a hot-air sterilizer built of concrete and brick for the disinfecting of clothing. You should by all means see it, because it is improvised and therefore valuable. It is of metal, and the temperature is raised to 90° C. by a charcoal fire in a pan, and the things that are disinfected in it are those that can not be steamed, like outer clothing, etc. They had very decent baths, and as a general thing, gentlemen, all through this sector I noticed that the baths were very good. They were clean, with provision made for the issuing of clean clothing, of disposing of dirty clothing, which was taken in, disinfected, and washed, and for undressing and dressing rooms. The water in the tub baths was heated. The latrines were of the usual squatting type.

It was explained to us that the road from X was in plain view of the Germans, but that it was camouflaged very heavily—of course the boches know where the roads are, but by camouflaging them they never know when the roads are occupied by troops, save through aircraft. At the time of our visit they were making a change of divisional troops—those at the front retiring and being replaced by others, always a time of some uneasiness, and we could hear certain evidences of activity in the distance. We went up the road for perhaps 4 km., and reached, first, an advance station of the G. B. D. (ambulance company, in our language, and groupe de brancardiers divisionnaire, in French). It was interesting for several reasons. It was directly on the main road of traffic between the rear and the front, a road which, by the way, was in excellent condition. It was well up near to the lines, and it was sunken in a cut. Into that cut they had built their dugouts. At the time we were there they were converting their G. B. D. into something very interesting. Remembering what we were told the other day by the regimental surgeon that the G. B. D. station, and especially an advance post of the G. B. D., was a collecting and forwarding point—it is interesting to us that they have made at the site of the advanced post of the G. B. D. a special hospital for the reception of nontransportable cases. I was curious to see what this was and we went into it. It was in the process of construction. They had dug into the hill or little rise of ground, right behind the dugout and the G. B. D.; in other words, it was an extension into it. It went right down and they thus got very good cover; I guess about 18 feet. It was well constructed, the angle of descent was not sharp, and it was ample in width, with well-made steps. There was a vestibule with space between the two curtained doors for a litter. When we reached the bottom I was very much surprised to find a very well-equipped set of galleries. The galleries were the usual kind; they had large wards dug out for patients, and a very good operating and sterilizing room, each separate and painted white; both of these rooms were lined with corrugated iron. There were the usual kitchen, offices, etc. I should say there were 20 beds.

It was a special surgical hospital, he said. "In other words, we are entirely independent of our poste de secours, and it is necessary here to have a surgical hospital for the treatment of cases that are held by tourniquet, or by deep shock, or by reason of abdominal wounds; a place where they can be kept until safe to send them back." It occurs to me that such a place in a battle would be rapidly filled, and I think they would be bad off in half an hour for room.

We then went to the regimental post, which was a good one and just across from the G. B. D. It was well protected, being built into the side of the hill, which ran in far enough to give a good outer entrance, a vestibule, and an inner entrance and then descended down a gentle grade with broad steps until they were—about 20 feet—below the surface. It was perfectly protected from direct hits. This station was interesting because it was mainly galleries—there were no wards—with plenty more that were offshoots from the main ones and which were converted into operating room, dressing room, hot-drink room, medical officers' room, Hospital Corps men's room, and so on; the main gallery accommodated the patients and along the wall instead of having beds they had racks that they let down. The racks were pushed up against the wall and when a patient came in a rack was let down and the litter was placed upon it. Their capacity was 60 lying and 40 sitting. The place was extremely clean, very well ventilated, and had three exits—in fact, all through this sector they insist on three exits. It was well whitewashed, quite well supplied, had a telephone, and the place was well heated and well lighted. At the farther end one walked right straight into the regimental commander's office. In this, the regimental commander's headquarters, the regimental infirmary, and the aid station were in one and the same dugout. The medical officer was a most pleasing character, a man with an alert expression in his face and a military bearing; he had everything well administered, and was on good terms, undoubtedly, with his commanding officer. Everything went on nicely there, they said.

I omitted to mention that at the advance post of the G. B. D. there were two automobiles kept standing all the time. These two automobiles were sent out from the G. B. D. post at X——, and were from the S. S. A. (Service de Santé Armée ambulance section), which consists of 20 ambulances. There were 16 at X—— and 4 out—2 at this advanced post and 2 at another.

Now, near this regimental station in a separate dugout was a group of litter bearers belonging to the G. B. D., on the principle we have seen initiated by the French that every regimental aid station should have near it a receiving and forwarding station manned by litter bearers of the ambulance company. When they get pushed they just simply evacuate into this substation, which is made commodious to receive patients. That is the only thing it does and it is their extreme forwarding limit.

From here we struck out for the trenches. Up to this time we had been on an open road—the regimental aid station is on the side of a road, and although in a dugout it was approached in the open, but now we started up an approach trench to the communicating trench, and we very soon came to where the ground was stripped and all vegetation blown away by shells. We were in territory that had been wrung from the Germans and, naturally, it bore marks of it. I should say we must have walked at least 2 km. before we reached the poste de secours of the battalion. The trenches were very well drained indeed. The earth helped that. It was a little chalky, but was frozen. They complained bitterly about the mud there, but we didn't see very much. They were very free from water in those trenches, which were much deeper than the English ones and gave much better cover. We saw many evidences of bombardment and picked up some fresh pieces of shell. The trenches were very well marked with signs pointing out routes, especially in the vicinity of the poste de secours. The division surgeon who took us was evidently not very well acquainted with these trenches, which were, however, well labeled with fanciful names, changed from time to time. He lost his way two or three times, but we finally got up to the battalion aid post "St. Jean." It was an old German aid post which was built evidently a good while ago, and it had no place for the litter to rest between curtains. Of course the object in having a vestibule long enough for a litter to rest in is that in times of gas when they get in they want to close the curtain behind them before they open the second curtain. Nothing of the kind is possible in this battalion aid post. It is a sheer descent at an angle of certainly not less

than 60°, right straight down. It is almost like climbing a ladder, and was in very bad repair and badly organized. Approaches to dugouts ought not to be at more than 30°. Our regulations call for 45°. You can not get a litter out at that angle without danger to the patient and without exceeding difficulty, and there should always be steps.

This aid station was one of twins; it was one of two battalion aid posts for the same battalion. Two were needed because the battalion was spread out over so great a distance that one was not enough. The officer in command of the place showed us his gas curtains. He seemed to be more exercised about gas than anything else. Evidently they did very little in a surgical way, nor would it have been possible to do anything in a place of that sort. The only thing that they spoke of there in connection with surgery was tourniquets. That seemed to be about all; but the young fellow was only a medical student at any rate. But he did speak a great deal about gas and about a gas curtain he was inventing. I don't think his gas curtain could be used with any degree of safety because it took too long to put it on.

From there we went across through the support trenches on the edge of the line to the *poste de secours de Maline*. That was the other twin and was in very much the same condition. What can be said of one can be said of the other. The inherent trouble was that they had accepted old German stuff that did not give adequate protection against gas. They were small and badly supported.

We then returned on the third leg of the triangle and took the automobile for "grouperment" of field ambulances. I invite your attention to this particular group because it was a revelation to me. I have seen a good many of these units, and it undoubtedly represents, as far as I have seen, the ideal and model of the French triage system. It is an ideal which is very rarely obtained apparently. The three field ambulances here grouped together from one large immobilized field hospital, reinforced by certain modern field hospital equipment to make it complete enough for this war; it is near the front, perhaps 5 km., in a fine château, with ample, more than ample, buildings, barracks with ample tentage, good roads, and unusually extensive protection against bombardment. It was right at the side of an abrupt hillock, a formation we have read of as the "kopje" of South Africa. Into that hill they have run tunnels which afford protection for all that may be in the hospital, and are constructing covered ways to get there from the wards. In addition they have built splinter-proof tunnels beside the wards and made of corrugated elephant iron, linked together at the top; these are covered with sandbags and earth, making them splinter proof. The first thing that struck me about this group of hospitals was its commander—a keen looking man who was evidently a good administrator; a man with common sense, very direct manner of speech—but not at all verbose; and a man that had a decided opinion about everything without being intrusive with it. All of his assistants were just about the same sort of men—as you may expect when you have a good leader. The first thing that we saw was that portion of the hospital which I have referred to as the advanced surgical hospital for nontransportable cases. That was in barracks. The wards were exceedingly clean, very cheerful—the most cheerful and the cleanest wards I have seen in a French hospital. They have female nurses and fine decorations around the walls, all in good taste. The place was clean and it smelled clean. The operating was done in a barrack behind the triage.

Here we began by inspecting what we have had described as the *groupe complémentaire de chirurgie*, the portable motor truck radiologic outfit and operating hut drawn on a trailer. It furnishes one hundred and fifty 32-candlepower lights and does the radiologic work at the same time. It carries a complete operating room and radiograph room. Here we had explained to us what a surgical "équipe" was. It is an operating team and consists of 1 operator, 1 assistant, and three male nurses. There were in the place 3 operating rooms and 3 sterilizing rooms, and they were large. I do not believe they need 3 sterilizing rooms, still they seemed to think they did. An interesting feature of those operating rooms was that they were always kept warm. I noted that their thermometers read 33° C. They had gone to the expense of putting in a hot-water central heating system, but they had stoves in addition, in case the central system broke down. They had lots of electric lights from power furnished by the town near by. I suppose it is run by the military government, but arrangements had been made in case it broke down for switching on the lights of the radiograph outfit, and in case that breaks down they have a third recourse to oil lamps, which are large. They kept 3

operating teams there, but in time of intense activity, in order to run 3 tables, they need 9 teams, each team working eight hours continually. Before a man reached the operating room he went through the receiving and the preoperating rooms, and I think these were fully as interesting from our standpoint as anything we saw. The preoperating room was a room where the man was cleaned up; his clothes taken off and mud scrubbed off him, and as soon as he was made clean he was taken into the room for heating. Now, they had 9 or 10 litters on supports, covered by canvas hoods—canvas spread over barrel hoops and closed by a wooden bar at the bottom but perforated by a little stovepipe 2 inches in diameter, stopping about a foot from the floor. The man was put under this hood, and a blanket thrown over the hood and drawn round his neck. A lamp was put under the chimney while we were there and within a few minutes it was tolerably warm—a thoroughly good way of heating a patient. There they were heated and from there, of course, they went to the operating room; that is, after passing through the radiograph room for a radiograph. After operation they were put in one of two wards which held 24 beds each.

In time of action this preoperating and heating room was under the charge of a medical officer, who remained there on constant duty. He doesn't do anything at all but watch these patients and see that they are put in shape for operation. That is his sole duty. If they needed stimulation he gave it to them—whether it was hypodermic or whatever it was. He was the man who decided when patients were fit to be examined in the radiologic room. In other words, he had full charge until they were delivered to the surgeon.

We next passed to that part which has always interested me, the evacuation section of the hospital and triage of same. It was a group of tents whose whole capacity, I should say, was not less than 1,000. These tents were double lined, very clean, very comfortable, easily warmed and remaining so longer than barracks. They had sanded floors, and were well fitted up with beds; there were not any cots, or blankets on the ground; they were beds and they were good beds. In connection with this evacuation group there was a triage room. Patients were received there, their dressings were taken off, and a medical officer made an examination of the wound, confirming or disapproving the diagnosis. He decided what should be done; whether the patient should be moved on to the rear or operated upon in the hospital. If he was to be moved to the rear he was sent to one of these tent wards; that is, a lying patient to a recumbent ward and a sitting patient to a hangar. At its very best this elaborate triage didn't appeal to me as being a thing that was absolutely necessary unless this was to be the principal surgical hospital. If it had been just a few that were to be sent back it would have been all right, but just to get a few to be kept it wasn't all right, because it delayed things. It was absolutely clean, apparently orderly, well administered, and undoubtedly if the plan wouldn't succeed there it wouldn't anywhere. The medical officer told me he didn't know whether it was a good thing or not. He intimated that this triage ought to take place at the hospital where the operating could be done, on the majority that needed it, but he didn't say so.

Now, these double tents are known as Bessonneau tents. The Bessonneau tent is the tent. There is no question about that at all. It is the non plus ultra of military tents in France. The Bessonneau hangar, braced on the principle of a cantilever bridge, is an enormous tent. There is one here at ———, but to see one of these things fitted up with beds is really a sight; it was really a most beautiful hospital. Here was an enormous tent, warmed comfortably by a central heating system, with 125 beds, and sanded earth floor.

We now came to their center for gassed cases, which was new, as in this sector they had a good deal of gas. All are more afraid of gas than they are of wounds, and the majority that they get are gassed. An English C. C. S. we saw (No. 23) has a shed, open on one side, for these cases. The French have an open shed, but that open shed is simply for the purpose of triage. They handle the gassed by chlorine and those suffering from the vesicating gases in separate wards, as the two are treated quite differently. The chlorine cases are taken immediately and put comfortably to bed. We saw a whole ward of them, and the medical officer in charge called attention to their universal slow pulse, 40 to 50 per minute, which remains that way for days. The vesicating gas cases have to go through a much more elaborate process. There is a long building, with cemented floor and well warmed. The patients remove their clothing in that room—the receiving room—which is well warmed. In the next

room they bathe under a shower of warm water. In the next room they are laid on a table; are given an alkaline rinse and their eyes are washed out with the same solution. Finally, in the next room they get new clothing. This suite of rooms took up the whole barrack. That's one thing about this place: Where they needed a room they provided it and it was big. Then the man was evacuated; he didn't stay there like the chlorine cases. He was put away in other barracks. These gas cases can not be transported very far back. The field hospital is where they should be; no question about that at all.

The bathrooms are like everything else in this station—well administered. There were shower baths with hot water. There was a dressing room where men took off their dirty and put on clean clothing; and a window through which dirty clothing was discarded; a place where they put away their outer clothing, little racks which extended through and through the wall into the dressing room. For instance, No. 24 put his clothing in No. 24 cubby-hole and went into the bathroom and bathed. While we were there some were soaping; others washing off. When he finished bathing he went into the dressing room, where he got clean underclothing and received his disinfected outer clothing. They ran 75 an hour through that bath. There were about 20 shower heads.

Here is something worth considering: It was a disinfector, a "Purey," type 4, model Exshaw & Co., of Bordeaux, and there was a great deal of mystery about this thing. It was enormous, weighing about 11,000 kilos, and it was supposed to travel under its own steam. It had a hot-air sterilizer—dryer they call it—which had very large capacity; at the rear it had a steam apparatus for clothing; so you turned steam into the back part and hot air into the front part of the dryer. Of course, it was too huge to carry over the country, and it burned 500 kilos of coal a day—entirely too much. They also used coke in it at times. It is too heavy, it costs too much, and the French have no use for it at all. Later on we saw one that they did have use for.

At this hospital the nontransportable in an attack are held here for operation, the gassed at the gas quarter, and the rest are hurried to the rear. The last place visited was the tent bathing outfit for a cantonment, known as the section d'hygiène corporelle (which is elsewhere described). There were 7,000 units of underwear kept in stock here for issue.

Antitetanic serum is rarely ever given at the aid station in this sector; it is given generally at the triage, but it ought to be given at the aid station. We can do it, and we ought to do it.

I want to say two or three words about this hospital; just a few things. This grouping of field hospitals is manifestly a better way of handling the situation. If you group three field hospitals together—I am assuming an immobilization of hospitals—if you immobilize them, this is the proper way to do it, provided the place has a proper tactical value and all other advantages. If they can be grouped I believe you get the best results, because if you group them, one radio-surgical outfit will do for the whole thing—will attend to all of the radiology for you—beside a whole series of economies in other services.

We had a very good illustration to-day of the difference between a mere doctor and a man who was an administrator of a hospital. There is no question about it, gentlemen, that one of the most important things that we have got to learn is how really important a director of a hospital is; and when you commence to talk about administering a hospital you have got to combine all the qualities of good common sense and professional ability in one. This man was thoroughly on his toes. There was not a part of this building that he didn't know about, nor a detail of its professional work. Everything was perfect, and there he was in mud 4 or 5 km. from the front.

The last place we visited was the other advance station of the G. B. D. We there saw installed an emergency surgical hospital similar to the one we had seen in the early part of the day, but drawing from another part of the line. From one direction this place was reached by going over exceedingly rough country and very much exposed indeed. On the other side they had the canal. So at each of these advance posts of the G. B. D. there was a special surgical hospital, as we have mentioned. This one didn't differ except that it was in a barrack and the other was in a dugout. I think it was a mistake to put it in a barrack. The personnel of this surgical hospital is, at first sight, strange—1 chemist, 1 corporal, and 4

Hospital Corps men. I asked why there was no medical officer, and he said this advance post of the G. B. D. is next to a battalion aid station. When wounded come in they are very apt to be from that battalion post and their doctor is near. If they are bad cases he telephones to the field ambulance for an operating team. The operating team comes up and immediately starts to work with what the enlisted personnel prepares for them.

The noncommissioned officer said he was a chemist. Colonel Porter wanted to find out how much chemistry he knew. As a matter of fact, he is probably a drug clerk. But they are pretty good men. With what they knew before and what they learn by experience they are able to help out. They do very well in carrying out work that is laid out for them, but they can't usually originate anything; they appear to have no important administrative duties.

The Vermorel apparatus that we were shown in the trenches is not very much used for the purpose it was originally intended—to neutralize air. It is a sort of a hand-grip apparatus, supposed to spray the air with a hyposulphite and bicarbonate of soda solution, and this is intended to clear the air of chlorine gas; and it is also supposed to wet the curtains. It is all right for wetting the curtains; you can't use anything better, but French officers say it is not worth very much for clearing the air. The Tissot apparatus is nothing but the English box respirator, but it is better and lasts longer. An oxygen tank is, of course, kept in all of these stations. The poste de secours will have 500 l.; a regimental poste will have 2,000 l. They also have a large number of rubber bags that they can pump up with oxygen. They seemed to be very much afraid of gas. They bore a hole in the French mask and put a little piece of gas tubing through it; then the mask is connected up with the oxygen bag direct. If the oxygen fails it don't hurt, because the man is protected from gas. This was really very ingenious. Of course, there are other ways of giving oxygen; the English give it by the Haldane apparatus.

Army Sanitary School No. 90.

NOTES BY GROUP OF STUDENT OFFICERS OF SECOND SESSION, ARMY SANITARY SCHOOL,
VISITING RIGHT SECTOR, JANUARY 29, 1918

Group under Lieutenant Colonel Shookley, M. C., United States Army

(This group visited the same sector as Colonel Ashford's group, described by him in a summary made to the class on January 28, and detailed elsewhere. Additional notes are here added covering features not previously dealt with.)

Group consisting of 8 medical officers left ——— at 7 a. m. in ambulance and after a run of about 10 km. to the northwest, made its first halt at the group of field ambulances previously described. It consists of three field ambulances in one group with a groupe complementaire de chirurgie. The hospital had a capacity of 500, but was capable of being expanded to 1,500.

In the receiving room of the triage was an arrangement for heating up cases who were shocked—canvas hoods, and hot air from a lamp which burned beneath a pipe leading thereto. The ward itself was heated by the "cloche" stove upon which were kept tins filled with sand for filling bags. Here the man was cleaned up, shaved, and a definite diagnosis made if possible. The wards were some of the "Adrian" type and others of the Service de Sante, the latter being far superior and warmer. One of the patients (and he was asleep) was a wounded German taken in a small raid the night before. The radiologie plant was installed just outside the operating rooms, which were in a long barrack building, but it was connected with them by a covered way. They had removed the partition in the portable operating hut and were using it all as an X-ray room. There were two Bessonneau hangars, each with over a hundred iron bunks all made up in case of a rush. They were heated by an outside hot-water heater whose pipe ran along one side of the tent and had many metal disks threaded upon it to increase the radiating surface. They were perfect in their neatness and were comfortably warm. Here was also the headquarters of the G. B. C. (groupe brancardiers du corps), the litter-bearer group of the army corps.

There was also a supply depot which was well stocked, although the Thomas splints were scarce. There were about 500 hand and many wheeled litters which later were folded

up and were packed in motor trucks for immediate delivery to divisions. Here also were kept the supply of reserve masks for the corps (both Tissot and M²) and in connection therewith was a small repair shop for remedying slight defects.

There was a small water analysis laboratory in charge of a pharmacist, a commissioned officer, who had devised an automatic feed of Javelle water to a reservoir so that just the proper amount was added to sterilize it. There was a constant chemical check made on results.

The scope of this group of field ambulances is as follows:

1. Triage.
2. Operating center for slightly wounded.
3. Operating center for severely wounded.
4. Gas center for treatment.
5. Laboratory for water analysis.
6. Medical supply depot.
7. Dental dispensary, fitted up much as is our own portable outfit.

The hospital was served by female nurses.

A bathing establishment was now inspected. It was the new tent outfit for cantonments and divisions in the line known as the section d'hygiene corporelle. (This is elsewhere fully described.) The clean clothing issued is of three sizes—large, medium, and small. Uniforms are disinfected in about 20 minutes by the autoclave. Men go directly to this bath from the trenches before occupying billets. Near this bathing establishment was an advance operating station (previously described). There was a total capacity of 30. Even this had its bath and system for issuing clean clothing. There was no good reason for having such a station here, as the field ambulance group, previously described, was near by.

The city of — was now visited and lunch was served in the field ambulance formerly occupied as a civil hospital. As a relief was in progress in the sector of the division surgeon who accompanied the group, he explained the necessity for showing the aid stations near this ambulance rather than carry out the more extensive program planned for a more distant tour through a sector passed over the day before by Colonel Ashford's group.

Before leaving for the trenches the ambulance, which served not only as a triage but as an advanced surgical hospital for nontransportable cases, was demonstrated. The entrance to the cellar was from the courtyard of the hospital down a broad-stepped stairway with a gentle grade for about 40 feet. The receiving ward was large and well heated by a "cloche" stove around three sides of which were built ovens. Every room was white-washed and well heated in this ambulance. The kitchen and messroom were on the surface. From this cellar one could descend some 30 feet farther down to some subterranean passages said to be of great antiquity and several kilometers in length in various directions. The tunnels were fully 6 feet square and were said to have never been fully explored. They were probably old wine cellars.

After traversing the destroyed portion of the city by a communicating trench, through back yards, under ruined walls, twisted railway tracks, and in and out of cellars, the trenches were entered directly from a street running north. After a short distance the regimental aid station was reached. Its entrance was at an angle of 30° to 35° and admitted a litter between curtains at the vestibule. This station was in the cellar of a ruined house and was not more than 10 or 12 feet underground. There were two entrances, but only one was seen. It was about 30 feet long and 6 feet wide and divided into a room for the regimental surgeon, one for office, dressing of patients, and supplies, and one to hold 6 or 8 enlisted men of the Medical Department on duty there and bunks for 5 or 6 wounded. This station was only a few feet from the camouflaged road to which patients were evacuated by a back stairs through a hole in the wall for transportation by ambulances at night. The light was electric; the air was dry and warm, but the station was overcrowded, small, and inadequate. Supplies were abundant—reserve of masks, 2 or 3 Tissots, 1 Vermorel sprayer, 3 or 4 Draeger oxygen apparatuses, as well as rubber balloons filled with oxygen. Thomas splints and tourniquets were seen, but no definite arrangements had been made for treating shock. The regimental surgeon's room was rather comfortable and had a metal bed. Eight to ten litters were kept here, but no heating arrangements were seen.

From this station the battalion aid stations were visited. They were close together and were, in common with the regimental aid station, all on the same communicating trench. The first, was a quarter of a mile away through unrevetted trench without any apparent provision for drainage, but clear of mud. Cement tanks holding 15 gallons of water were seen at intervals in this trench and were provided with taps. This battalion station was located just off the communicating trench under another ruined building with not over 9 feet of head cover. It also was within a few feet of the road, camouflaged by the wall of the house. The entrance was down an easy grade, but the dugout was small and extremely crowded. The main room was hardly 8 by 8 feet and connected by passageways with smaller ones. The first room contained supplies of drugs, bandages, splints, tourniquets, and certain gas defense stores. Some operating instruments were seen, but few facilities for operating. There was room for four patients in one chamber and for the personnel in the other. On the way out a higher level room was encountered little more than splinter proof. Here, owing to shelling, the party was held for a while before being able to return. It was noticed that the gas curtains here did not reach the ground by 2 inches. No latrines were seen in this trip. The second battalion aid post was much like the first and shared all of its defects.

Army Sanitary School No. 91.

THE MEDICAL CENTER AT ———, MAY 10

The hospital was a corps field ambulance, designated 12/2. This was not far from H. O. E. 32, and is one of the medical centers for the ——— Army. It is in a picturesque country, with a fine, old château in a beautiful park full of flowers, with many large trees, a little stream, and a lake. The patients are hospitalized in huts. The capacity of the hospital is 400 beds, and 3,000 patients have been received here since September, 1917, with an average stay of 10 days. The men are first admitted to the triage. Here they are deprived of their clothing and equipment, bathed, inscribed, and sorted into three groups:

- (1) The slightly ill who are not expected to remain in the hospital more than six days.
- (2) The incipient cases of tuberculosis and those under suspicion of having that disease who are sent to the interior as soon as their diagnosis is made.
- (3) All other contagious diseases.

We went directly to the huts set apart for the slightly ill; that is to say, for light cases of general medicine not contagious nor tubercular. The patients seen in the wards were chiefly suffering from respiratory diseases. There were many cases of bronchitis, some diagnosed as influenza, one with laryngitis, another with pleurisy, one with pneumonia, in a dying condition, and one with CO poisoning.

In another building were the infirm cases. These were only the slightly sick; heart cases are not taken here. In the rear of these huts we were shown the baths for the personnel of the hospital and for the patients, and a portable laundry of the type bought for the camp hospital of the 1st Division last year, it required 4 men to turn out 250 pieces a day. The baths were the usual ones—small, with undressing, bathing, and dressing rooms. Near the laundry was a large drying shed for sheets.

We next visited the section for cases of tuberculosis. This is separate from the rest; and as soon as a man is diagnosed and carefully examined as to the extent of his lesions, he is evacuated into the interior. Men with incurable open cases are sent to sanatoria, closed cases are sent to duty with the auxiliary troops in the back areas, but none are sent back to the active army at the front. In the diagnosis of tuberculosis, radiologic as well as laboratory methods are employed, and these are carefully checked upon by physical examination by medical officers.

The administration building was in the château. One motor ambulance stood in front of the building in case of any serious surgical situation arising among the patients, as there was no surgeon or operating room here. In this administration building was the radiologist and his equipment, which was limited to diagnostic and therapeutic application. There was a laboratory for the hospital which was only a clinical one. The pharmacy was clean and bright. It attended to the clinical examination of urine and other secretions.

THE CONTAGIOUS DISEASES SECTION

First ward—measles and scarlet fever; 6 cases of the former and 1 of the latter. They were separated by a partition and the same nurse cared for both.

In the next barrack were isolated all cases of enterocolitis, including dysentery and typhoid. They stated that they had only two cases of amebic dysentery since they opened and what they actually had in the hospital at the time was due to banal organisms.

In the next we found mumps and diphtheria. The same remarks apply to this as to the measles and scarlet fever hut. There were 8 cases of the former and 1 of the latter. They stated that mumps is the most frequent contagious disease they have to deal with. They have great faith in Vincent's powder to rid carriers of the bacillus of diphtheria. It is used locally, and they report that throats are freed in about two months.

The next hut contained all the anginas. They stated that Vincent's angina is a very common form. They treated it with injections of novarsenobenzol.

The next two huts were filled with venereal cases. Only patients in the first and second stages of syphilis and acute gonorrhea were received here. The treatment for syphilis consisted in 4 injections of novarsenobenzol, one each week, beginning with 35 eg. and ending with 90. They inject daily for 10 days, cyanide of mercury, beginning with 2 eg. and gradually increasing; then discharge them with a little potassium iodide.

We were now taken to the very handsome château of a champagne merchant of ———, a mile from this field ambulance. This was really a rest station for officers and noncommissioned officers and looked like a good type of English country mansion. It was situated on a height, in a large park, well laid out with trees and flowers, and has a high open portico commanding a superb view of the surrounding country, on which patients could sit and read. It was a most ideal spot for an officers' convalescent hospital, as it was quiet and near no town. The gatehouse, which was picturesque, was given over to noncommissioned officers, and here also luxurious house conditions met all of the necessities for sick men. English nurses had charge of both officers and noncommissioned officers. The big château was occupied by both English and French officers. The peculiarity of this hospital is that a man can not be evacuated to another formation in the rear without an order from G. H. Q.; he must return to his duty within three weeks. I saw my first case of acute articular rheumatism in France in a noncommissioned officer at this hospital.

BATHING SECTION (SECTION D'HYGIÈNE CORPORELLE)

We now visited a section for personal hygiene in a cantonment not far away into which English troops were pouring. The plan of this bath system will be found elsewhere, but its functioning at this place will be described. It was on the edge of a cantonment for 12,000 men. There are bathing facilities for 10,000, as 1,000 can be bathed a day; 40 can be bathed at a time, and require 20 minutes for the operation. An English company was going through as we reached the place. First, there is a disrobing room, fitted with latticed benches, the space thereon required for one man bearing a number corresponding to that assigned him by a numbered wooden check on admission. The outer clothing of the bathers was put into a large mesh bag bearing a number also corresponding to this number. The clothes were sterilized for 20 minutes, the time that he would require in getting his bath and his fresh underclothing. In addition he receives when he enters a small bag for his valuables, which bears the same number as the wooden check he has received. It is turned over to an assistant, after deposit of the soldier's valuables, to be put in a large basket, which is thereafter locked. This is sent to another tent near by from which he is reissued his bag after dressing, on presentation of his check. The men then pass into the bathroom proper, which has cubby-holes in a set of shelves, each cubby-hole being numbered with the same number as that upon the tag or check, into which he places his shoes and hat. Here are 20 shower heads; 20 men wet themselves under the bath, then step aside and soap themselves well while a second 20 wet themselves and so on, the first 20 bathing while the second 20 is soaping. They are given 10 minutes to take the bath. It requires 12 liters of water per man per bath. The floor is latticed. The men receive their soap before they go into the bath and a towel after they finish. They pass into a small drying and dressing room, where they are given a towel and a suit of

underclothing, and later they receive their own outer clothing from the autoclave which opens into the room in which they are dressing. There is also a tent near by for dirty clothing. This dirty clothing is all sterilized and sent down, to a nearby town for laundering.

The personnel required to operate the bath consists of 1 sergeant, 1 corporal, and 14 men. Every cantonment has one of these bathing establishments, and one is assigned to each division. This happened to be a corps establishment. It is to be remarked that the soldiers are bathed here by organizations and it is what the English call a "parade." They come in from the trenches and the first place they visit is the bath. As a result of this bathing system some very interesting explanations can be given concerning the assertion by the French that they are not so lousy as before. This, as a matter of fact, is so, and it seems to be so because all bathing and disinfection now belongs exclusively to the French Medical Department. There has been a sensational drop in the number of louse-bearing and itch-bearing French soldiers since this department has had charge of this important means of preventing disease, with an almost complete disappearance of trench fever, which is giving the British at present so much trouble.

MEDICAL CENTER ESTABLISHED BY A FIELD AMBULANCE

Here was installed another field ambulance that took care of medical cases in this region. This was a quaint old monastery, founded in 1126 by the Trappist monks.

This field ambulance accommodates, in Adrian huts, 600 medical cases and they have a triage dividing their patients into four classes: (1) General medical, (2) cardiac, (3) tubercular, and (4) contagious. Everything was much better than at the other place and better isolation was observed, because no two contagious diseases were put in the same barrack. The medical officer in charge was a most delightful man and thoroughly scientific. He was very interesting in his description of how he managed to find a place for the isolation of those admitted to the hospital who were not yet diagnosed. Rather than open a ward, he has found a room divided into stalls, which was used for silent prayer and in which the monks were confined at times. Sick men with suspicion of disease now occupied their place. The wards are all served by men, for the Trappist monks do not permit any women in the building, nor on the grounds or anywhere around. In conversation we found that there had been 115,000 cases of typhoid in the first six months of the war in the French Army because typhoid vaccination was not obligatory at that time. They hastily vaccinated the entire French Army by order, and it is said that at present they have not one case in any part of France. They use radiology here for diagnosis in chest and heart conditions very extensively, but there is no operating room. There was a little laboratory, which is merely a clinical one. It was at this hospital that I saw my first case of spirochetal jaundice. They said they had had 40 cases in this hospital at one time.

Army Sanitary School No. 92.

EVACUATION OF WOUNDED IN ZONE OF ADVANCE

By Major McDonald, Medical Corps

The work of the Medical Department in the divisional area during active fighting consists principally in the collection of the wounded in sheltered places, their emergency treatment, and rapid transportation to the hospitals in rear of the battle zone, with the minimum hindrance to military operations. The severely wounded man must be delivered at the evacuation hospital, the nearest completely equipped hospital to the front, in condition for immediate operation within 8 to 12 hours after the receipt of his injury, in order that he may have the maximum chance of rapid recovery and subsequent return to the front, or to civil life as an asset. Battles are won by man power, and the Medical Department is essentially a salvage department to maintain that power at the front. The effectiveness of man power in battle depends largely upon the physical force and the morale of the fighting men. Next to good health, good arms, and good training, nothing braces a soldier's morale so much in battle as his knowledge that an efficient Medical Department is at hand and ready to render him assistance in case of injury. Sympathy and humanity are not incompatible with the work of the Medical Department in battle, but its primary considerations are salvage and morale.

Paragraph 330, First Service Regulations reads as follows:

The personnel of the sanitary service in the zone of advance may be classified into two general groups, as follows: First, that attached to organizations smaller than a brigade, with functions under the immediate orders of the organization commander and accompanies it into combat; second, that attached to the sanitary train which functions under the orders of the divisional surgeon in accordance with such general or specific instructions as he may receive from the division commander. When necessary the sanitary personnel attached to organizations may be temporarily detached in whole or in part, and directed to operate with the sanitary train.

LINES OF ASSISTANCE FOR THE WOUNDED

1. The first line of assistance for the wounded on the battle field is furnished by the group of the sanitary service attached to regiments and smaller organizations. As noted in Field Service Regulations, this personnel functions under the immediate orders of the organization commander. The senior medical officer, designated "regimental surgeon," is a staff officer of the regimental commander and is held responsible for the proper care of the wounded at the front, and he supervises and directs the work of the Medical Department detachment. He consults with the regimental commander as to the time and place for establishing a definite or a provisional aid station, and as to the disposal of the wounded should it be necessary to leave them behind. For an Infantry regiment the maximum personnel of the sanitary service consists of 1 major, Medical Corps, and 6 captains or lieutenants, Medical Corps, one or two dental surgeons, and 48 enlisted men. Organizations smaller than an Infantry regiment have personnel in about the same proportion in accordance with their strength. This medical personnel is usually assisted by the addition of the regimental band and, in emergency, by details of men from the companies as stretcher bearers. Prisoners of war have been used as stretcher bearers in some battles of the present war.

The medical equipment for an Infantry regiment consists of splints, litters, surgical instruments and dressings, medicines (principally antiseptics and hypodermic solutions), and an oxygen-administering apparatus. These supplies are transported on three 1-mule medical carts. An additional box or more of surgical dressings and one or more litters are carried on each ammunition wagon. A regiment operating alone needs in addition 4 ambulances and an infirmary of 12 beds.

The function of the regimental sanitary service in battle is to render first aid to the wounded and collect them at an aid station in a sheltered place near the battle line, where they can be cared for and recuperated until removed by the stretcher bearers from the ambulance company. Whenever troops are advancing rapidly it is manifestly impossible for any definite aid station to be established, and the sanitary service can only render first aid to the wounded, collect them in more or less sheltered places near by, and leave them attended by one or two Hospital Corps men, to be picked up later by the ambulance companies. The sanitary service with organizations must stay with their organizations at all times. In trench warfare and at times in open warfare it may be necessary to establish battalion aid stations, since our Infantry battalions have been increased to more than 1,000 men. These aid stations are usually established from 400 to 1,500 yards in rear of the battle line, and they should be located in a place having some protection from fire. The Medical Department personnel collects the wounded at the aid stations from all parts of the battle field, but only in exceptional circumstances do the regimental stretcher bearers carry the wounded farther back than the aid stations. All transportation of the wounded in the regimental area is done by hand litters. The professional work done by the medical officers consists principally in the controlling of hemorrhage, application of splints and surgical dressings, and the treatment of shock and pain. Wounded should never be left on the battle field or allowed to fall into the hands of the enemy if it can be avoided, as the enemy will neglect them when he has all he can do to treat his own wounded. In retreat, especially if the losses have been severe, it may be necessary to leave some of the severely wounded, but sufficient sanitary personnel must be left behind to properly care for them unless competent civilians can receive them, as may be the case in friendly territory.

During attack in trench warfare the Medical Department personnel goes over with the last wave, or at the same time that regimental or battalion headquarters go over. When the military situation and the nature of the terrain permit, at least one well-protected aid station should be established for each regiment.

The requirements for a regimental aid station site are:

(a) Within 500 to 1,300 yards of the front line and near the area of the greatest expected casualties.

(b) In a place affording some cover from fire, such as dugout, a cellar, a gully or ravine, or a steep slope facing from the enemy.

(c) The site should have an approach from the front and to the rear under some cover.

(d) It should be in the natural line of drift of the wounded to the rear.

Unless such a site can be found, it is not likely that aid stations can be established during planned attacks until the advance ceases, the engagement terminates, or night sets in.

In defensive action, aid stations can frequently be established at the beginning of an action.

In Cavalry engagements, aid stations can only be established after successful action.

Of the wounded going to the rear from the aid stations, the severely wounded are transported by the ambulance company stretcher bearers to the ambulance dressing stations, while the slightly wounded are directed to walk back to the station for slightly wounded under the guidance of a corps man, or one of their number if a Medical Department enlisted man is not available. Frequently an officer or a noncommissioned officer may be found among them who can be put in charge of each group. It is forbidden for an uninjured combatant to accompany the wounded to the stations in the rear.

THE SECOND GENERAL GROUP OF THE SANITARY SERVICE OF THE ZONE OF ADVANCE

The sanitary train.—The sanitary train is commanded by the division surgeon in accordance with instructions given by the division commander. It consists of 4 ambulance companies, 4 field hospitals, 8 camp infirmaries, and 1 divisional medical supply unit. For administrative purposes the train is under direct charge of a lieutenant colonel of the Medical Corps, while the ambulance section companies and the field hospital section is under a major of the Medical Corps as director of field hospitals. The relation of the directors to their companies is very much like that of an Infantry major to his battalion, while the division surgeon bears a relationship to the directors very much the same as that of a colonel to the majors of his regiment. Three of the ambulance companies and three of the field hospitals are motorized and one of each is animal drawn. The eight camp infirmaries are animal drawn, each equipment being carried on one 4-mule wagon. The medical supply unit is transported on two motor trucks.

2. *The ambulance companies from the second line of assistance for the wounded.*—The personnel of each motor ambulance company consists of 5 medical officers and 122 enlisted men. The wheeled transportation available for wounded consists of 12 motor ambulances, each having a capacity of 4 recumbent or 8 sitting patients. In case of necessity the three 2-ton trucks used in transporting the company equipment may be used in transporting wounded. Likewise the touring car and three motorcycles may be pressed into this service in emergency. The only other means of carrying the wounded is by stretcher bearers on the standard litter, of which each company has 68. A wheeled litter has been proposed and will very probably be adopted.

The matériel which the ambulance company has for the emergency treatment of wounded consists of surgical dressings and instruments, splints, oxygen administering apparatus, medicines, blankets, heating devices, and medical comforts in the form of easily digested foods. The treatment given, such as the amputation of hopelessly mangled limbs, ligation of bleeding vessels, application or adjustment of splints and dressings, the stimulation and warming up of the wounded, aims principally to combat shock and enable the patient to be rapidly and safely transported to a hospital in the rear of the battle zone, where he should arrive in condition to withstand an immediate surgical operation. Ambulance companies form the second line of assistance to the wounded; hence on the battle field they must push up close to the rear of the fighting troops and as near the line of aid stations as possible and establish dressing stations in order to take over the wounded from the regimental medical personnel who must remain with their organizations. The ambulance companies operate over a zone of from $3\frac{1}{2}$ to 5 miles from front to rear, extending usually from the battalion

aid stations to the field hospitals. In the field operations the ambulance company is divided into a transportation section and a dressing station party, the latter including the stretcher bearers.

The stretcher bearers carry wounded from the aid stations, or farther front in necessity, to the ambulance dressing station, which is usually at a motor head. In some instances the dressing station may be established some distance in front of the nearest point reached by ambulances, and so an additional carry of the distance from the dressing stations to the motor head must be made by the stretcher bearers. Under certain favorable conditions the dressing station may be placed as far forward as the aid stations, in which event it takes the place of the aid stations; however, the distance to be covered in the ambulance company zone by litter transportation is usually from 1,000 to 3,000 yards, while the transportation of the wounded back over the remaining $2\frac{1}{2}$ to $3\frac{1}{2}$ miles or more to the field hospitals or other hospitals in the rear is accomplished ordinarily by motor ambulances. In exceptional circumstances animal-drawn ambulances must be used. When the distance to be covered by stretcher bearers is more than 1,000 yards it is of advantage to have relay posts for stretcher bearers. On all except very short carrying distances four bearers must be assigned to each litter. The bearer section of the ambulance company consists of a maximum of 80 stretcher bearers. Thus not more than 20 wounded can be transported at one time on litters by one ambulance company. In emergency, additional bearers may be sent up from sanitary units of troops in reserve. Ordinarily the ambulance company can not make use of the sanitary personnel of the organizations in the fighting line for stretcher bearing back of the regimental aid stations, as their time is fully occupied in collecting and caring for the wounded in their own area. It requires, on an average, one hour for four stretcher bearers to transport a wounded man 1,000 yards and return a closed litter to the starting point. In favorable circumstances it should not require more than two hours to transport a wounded man through the ambulance company zone, from an aid station to a field hospital. This permits half an hour at the dressing station for treatment and recuperation.

The ambulance dressing station is also a sorting station. The patients are sorted into:

(a) The slightly wounded, who are directed to walk back to the station for slightly wounded.

(b) The slightly ill and wounded not requiring immediate extensive surgical operations are transported to field hospitals.

(c) The severely wounded, needing immediate operation, are transported at once to the evacuation hospitals, or to a field hospital having a mobile surgical operating equipment.

From a tactical standpoint the following are the requirements for an ambulance dressing station site:

(a) Distance from aid stations should be from 0 to 3,000 yards. In trench warfare the average is 1,000 to 1,200 yards.

(b) In line of natural drift of wounded to rear.

(c) In a position known to the command or easily found.

(d) Easily accessible from front for stretcher bearers and wounded.

(e) As near as possible to the area of greatest expected casualties.

(f) Accessible to ambulances approaching it from rear along a covered or partially protected roadway which can be spared for the purpose.

(g) Cover from fire; should be out of rifle range and direct artillery fire.

(h) Shelter from cold, wind, and rain.

(i) Water, straw, and fuel.

(j) Usually the dressing station should be located at the ambulance head, where one or two ambulances should be stationed at all times.

(k) It should not be placed too near artillery positions, road crossings, munition dumps, and other points which are special targets for the hostile artillery.

Ambulance companies are responsible that all routes for evacuation of wounded in the divisional area are plainly marked. They are also responsible that all stations for the wounded are emptied as fast as possible so as to make room for new cases.

3. *Field hospital and stations for slightly wounded for the third and last line of assistance for the wounded in the zone of advance.*—Field hospitals are mobile hospitals, four to the infantry

division, each having a capacity of 216 patients. The field hospitals are established in a zone 4 to 5 miles in rear of the battle line, out of range of all fire except heavy artillery. Of the four field hospitals per infantry division, three are motorized, and the other is animal drawn. The transportation of a field hospital consists of eleven 2-ton trucks, one repair car, one touring car, and two motor cycles with side cars. This transportation is for the equipment and personnel of the hospital, but any or all of it may be pressed into the service of transporting the wounded in emergency. Tentage sufficient for patients and personnel is carried. The personnel of a field hospital consists of 6 medical officers (1 major and 5 captains or lieutenants) and 83 enlisted men. The animal-drawn field hospital has the same equipment and personnel, but seven wagons instead of motor trucks are furnished for the transportation of equipment. The nature of the surgical work done by the field hospitals is very much the same as that done at the dressing stations, though it is possible to do even major surgical operations in the field hospital. However, in the light of the recent experience in trench warfare, and due to the great advance in the surgical treatment of wounds, the evacuation hospital has become the principal place for definitive surgical treatment. Thus the rôle of field hospitals has become largely that of slightly wounded stations, rest stations, special gas hospitals, scabies and delousing stations. In open warfare it is very probable that the field hospitals will again have their principal work in the treatment of the wounded. Field hospitals receive the sick and wounded from the ambulance companies, and are evacuated by ambulances of Services of Supply organizations, known as evacuation ambulance companies, which convey the wounded to the evacuation hospitals located at a rail head 10 to 15 miles in rear of the battle field. The requirements for a field hospital site are as follows:

(a) Three and one-half to five miles from battle line, out of rifle and field artillery range.

(b) Accessible to ambulances from front and rear.

(c) Wood, water, straw, shelter, etc., such as may be obtained in a small village.

While tentage is carried for sheltering the wounded, it is very desirable to have buildings available for this purpose.

Stations for slightly wounded.—A station for slightly wounded is established somewhere in the field hospital area in order that the walking wounded may be directed to it for treatment in times of emergency when the aid stations and dressing stations farther front are taxed to capacity in caring for the more severely wounded. This station is established by a whole or part of the personnel of a field hospital, or ambulance company with the field hospital equipment, or with a camp infirmary equipment. If a camp infirmary equipment is used, 1 or 2 medical officers and 6 to 12 enlisted men must be drawn from an ambulance company or a field hospital to operate it, as no personnel is attached to a camp infirmary except one sergeant and a driver.

The station for slightly wounded should be established in a central location so as to be available for all the troops of the division, since only one station for slightly wounded is ordinarily necessary. It should be in the line of drift of the wounded to the rear, near the sector of greatest expected casualties, and should have cover from fire and shelter from the elements. It should be in a position easily accessible from front and rear and its location should be announced in orders.

The primary function of the camp infirmaries is to furnish dispensary facilities to organizations during field service.

The divisional medical supply unit has a personnel of 1 medical officer and 8 enlisted men. Its transportation consists of 2 motor cycles with side car and 2 motor trucks. Its function is to replenish the medical supplies of the sanitary train and organizations of the division.

The sick and wounded returned to duty from hospitals and other stations within the divisional zone return to their organizations, taking with them all their equipment. The sick and wounded of combat divisions returned to duty from evacuation hospitals are sent to a replacement division or to auxiliary depots of replacement divisions, which may be established in hospital areas. Sick and injured of organizations of the Services of Supply are returned to duty with their organizations.

Duties of medical officers on staffs.—(1) Advisory: Concerning all matters pertaining to the sanitary welfare of the command and concerning matters pertaining to the personnel and equipment of the sanitary service under organization commanders. A staff medical officer must be prepared to advise the chief of staff on the following points, per paragraph 4 of Field Orders:

(a) Time and place where sick of the command are to be assembled for transportation to the rear.

(b) Location of a station for slightly wounded.

(c) Location of dressing stations and field hospitals when it is possible to fix them in advance.

(d) The assignment of additional transportation for the wounded from the field train.

(e) The disposition of the remaining Medical Department divisional units until they are needed on the field.

(2) Administrative: In this capacity the division surgeon is in immediate command of the Medical Department personnel attached to division headquarters, of the sanitary train, and of Red Cross or other voluntary aid personnel authorized in some cases to perform service.

In order that the division surgeon may perform his work efficiently the staff must keep him informed of the military situation. In emergencies the medical staff officer may have to act on his own responsibility in matters that pertain to his department, for the commander and his staff are in all probability engaged in other important affairs at such times.

Number and classification of wounded.—Five to 25 per cent of troops engaged become casualties in a day's fighting.

The following table gives a classification of the wounded among 20,000 men engaged, assuming 10 per cent casualties:

Per cent of struck		Per cent of engaged	Per cent of wounded	Number in 20,000	Number of wounded
20	Dead.....	2		400	
16	Walking wounded.....	1.6	20	320	320
28	Sitting wounded.....	2.8	35	560	560
36	Recumbent wounded.....	3.6	45	720	720
100	Total.....	10	100	2,000	1,600

Sixty to seventy-five per cent of wounded will eventually be returned to the front.

Seventy-five per cent of wounds are produced by artillery or grenades.

Twenty per cent are produced by small-arms bullets.

Four and one-half per cent are produced by gas.

One-half of 1 per cent are produced by cutting weapons.

Twenty per cent of wounds are of the head.

Ten per cent are of the chest.

Five per cent of the abdomen.

Sixty-five per cent are of the extremities (one-fourth of wounds of extremities are fractures).

Army Sanitary School No. 93.

SURGICAL TREATMENT IN DIAPHYSEAL FRACTURES

Translation of summary of a lecture by Medecin-Major Leriche

There are two kinds of diaphyseal fractures: First, those produced by a bullet at ordinary range and causing punctiform wounds of the skin; second, those produced by other projectiles (high-explosive shell, grenade, shrapnel, or torpedo, and deformed bullets or bullets at a short range).

The first mentioned usually run the same course as a simple fracture, and no operative prophylactic measures need be taken. The others, as a rule subjected to the ordinary causes

of infection of war wounds (foreign bodies, fragments of clothing lodged in the traumatized region), must be operated upon prophylactically. We are here only concerned with these latter.

Perfect knowledge of the site of the fracture and its anatomical pathology is necessary for the good result of the operation.

I. ANATOMICAL PATHOLOGY OF THE SITE OF FRACTURE

Follow the course of the projectile. After going through the flesh it may: First, fracture the bone and stop there without penetrating the medullary canal (this is the fracture by contact); second, pierce the bone, splintering it more or less (these are the fractures by penetration, the real war fractures).

They may be of different types—transverse fractures, fractures with large longitudinal bone fragments, comminuted fractures with destruction of a whole section of bone.

Constituent elements of fracture by penetration.—Bone fragments: They differ according to their periosteal covering. Some are loose and more or less out of place; others are detached from the bone but still adhere to the muscle; others adhere to the diaphysis by the periosteum.

Fissures.

Involvement of medullary canal and marrow—specially important.

Condition of diaphyseal extremities.

Topography.

II. EVOLUTION OF THE SITE OF A FRACTURE

Spontaneous repair is possible even with grave injuries, provided the wound runs an aseptic course. This is the case with fractures produced by a bullet at ordinary range and causes punctiform wounds of the skin. An aseptic course is seldom seen in fractures produced by artillery projectiles, for fragments of clothing are often blown in.

Consequences of infection in fractures: First, gangrene; second, osteomyelitis.

The infection of the bone acts on all the normal elements of repair. Violent infection brings on complete destruction and pseudarthrosis. If it is less violent the marrow of the bone is destroyed and the periosteum grows abnormally.

The result is a central cavity limited by infected walls of bone and filled with small fragments. It suppurates endlessly and forms fistulas.

Conclusion: A prophylactic operation is absolutely necessary. One must be able to follow *de visu* the whole course of the projectile so as to thoroughly remove all food for infectious microbes and foreign material.

III. DISINFECTION OF THE SITE OF FRACTURE

First. Excision of the devitalized tissue as usual, with a special care for the seat of the secondary traumatism caused by fragments of bone.

Second. Cleansing of the site of fracture.

In fracture by contact, removal of all free bone fragments must be followed by surgical sterilization of the spot where the shell was lodged. Verify the medullary canal if it has been opened by a fissure. This generally suffices.

In fractures by penetration it is necessary to have an extensive view of the medullary canal, for there lies the danger. One usually has to detach two, three, or more adherent bone fragments, trying in the meanwhile to preserve an intact bridge of bone on the opposite side. Any amount of bone fragments may be removed as long as the periosteum is preserved.

Definition of the periosteum.—The periosteum of the adult is not an anatomical entity but a physiological one, made of fibrous tissue (anatomical periosteum) and of the layer of bone to which it adheres. This layer of bone is indispensable to the production of bone. Therefore, the operation will only have a good result if, with the fibrous periosteum, a thin layer of bone from the diaphysis is preserved.

Method of removing bone fragments.—Fix each bone fragment with a "davies," detach the periosteum from the bone with a very sharp rugine of Ollier. Cleanse the medullary canal.

Suture.—It depends upon the state of the tissues. Fractures by contact may often be sutured primarily. For fractures by penetration, delayed primary suture or even secondary suture is preferable.

In some exceptional cases primary osteosynthesis is advisable.

NOTES ON A LECTURE ON THE SURGICAL TREATMENT OF DIAPHYSEAL FRACTURES BY PROFESSOR
LERICHE

There are two classes of compound fractures:

1. Those caused by a modern, undeformed bullet at ordinary range, with punctiform wounds of entrance and exit.
2. Those caused by shell fragments, grenade and bomb fragments, shrapnel, and deformed bullets. These often bring about an explosive effect.

There are also two principal methods of treatment.

1. The closed, where foreign bodies and devitalized tissue can be removed and there is sufficient skin left to cover the wound.
2. The open treatment.

Let us trace the irregular fragment from the moment of entrance. It tears through the skin with a piece of clothing in front of it; passes to the muscle, bursting its fibers, and tears its way through the periosteum, leaving it frayed. Here it may be arrested by bone the "fracture of arrest" or "fracture by contact." This fracture is apt to be some modification of the "butterfly" type. Or it may enter the bone, lodging in or near the medullary canal, or it may perforate the first two-thirds of the diameter and blow out the last third.

The fragments.—(1) The aperiosteal. These are stripped of their periosteum completely.

(2) The fragment detached from bone but still holding to a bit of periosteum.

(3) The fragment still covered by periosteum throughout most of its surface.

Long fissures in a diaphysis radiate in any direction from the point of impact of the missile and need no special remark. The dangerous element is the condition of the medullary substance where a hemorrhagic zone extends up and down the shaft, thus reducing local nutrition in the bone in the vicinity. The fragments are usually pointed and jagged and partially deprived of periosteum.

Thus there is an intramedullary chamber of bone fragments between two chambers of muscle attrition, the one on the far side often containing blownout fragments of bone which not only act as secondary missiles but are carriers of infection as tiny bits of clothing hang to them. The reason why these fractures are difficult of healing is on account of the foreign substance carried in, especially clothing.

In 75 per cent of untreated cases immediate infection of destroyed muscle takes place by anaerobes generally with but one result—gas gangrene. If the patient should escape this fate he gets an infection of bone which is a true osteomyelitis, like that of adolescence. It extends up the medullary canal by bits of clothing or bone entangling fibers of clothing which have been blown in tangentially. The ends of the fragments die when these thrombi are infected and the marrow disappears by this process for from 4 to 7 cm. This takes away the main source of nutrition for the bone and a source of its regeneration. The final result is that the medullary canal is closed above and below the fracture. The live periosteum regenerates bone, but the nourishment of this bone is insufficient and it readily falls a prey in its devitalized state to microorganisms. Hence, bone is constantly being formed and as rapidly degenerated—fistulas form and may persist for life with all of their attendant chronic toxemia, etc. Leriche recently saw a man whose uncured bone fistulas dated from a compound fracture of the Franco-Prussian War.

Treatment.—In punctiform bullet wounds of entrance and exit, treat aseptically and do not operate, as these usually heal.

You can expect to get a good result from a primary or primary delayed suture in the shell wound or shrapnel cases if the fracture is by contact; i. e., without penetration of the missile to the medullary canal. But when penetration has occurred, always get at and cautiously remove part of the marrow with a curette—to the point just beyond which contamination has taken place. In such cases expose the site of the fracture by a large incision—clean out well. The gravity of a fracture of war is in inverse ratio to the size of the pieces of bone. Remove all bone free of periosteum, but do not remove splinters—especially long ones—which are attached to periosteum, except to get at the medullary canal, which you must see. Inspect each splinter well. Pick out patiently all foreign bodies and carefully wipe out of the chamber all comminuted bone with gauze-covered cotton sponges on forceps soaked in neutral soap solution (q. v.). This will get rid of pieces of clothing of

minute size which can in no other way be got at. The objection to removing a splinter attached to periosteum to get at the medullary canal is that you may have to do so at the risk of pseudo-arthritis; but osteomyelitis is worse. It is, however, indeed better to leave a bridge of bone between the fractured ends if possible. If you do all of this well you may be able to close in from two to six days, but this depends on what the bacteriologist says.

Now, when you decide to leave splintered bone which is contaminated, it is well to first rongeur off the contaminated surface. Also, if you decide to leave only the periosteum see that it is the physiological and not merely the anatomical organ that you leave. In other words, by Leriche's sharp rugine you should leave a thin layer of bone adherent to this anatomical periosteum to furnish osteo-genetic centers for the new bone.

Fractures caused by contact with the missile are the only ones that can be primarily sutured, but those penetrating to the medullary canal or perforating the bone, never. In the latter case always do a delayed primary suture or "submit the wound to the Carrel-Dakin method." The reason for this is that we never can be sure of what we leave behind if we close.

Plating and suturing of bones at the time of receiving the injury is discouraged. It retards the formation of callus and it has not worked well. We may apparently get a fine result and in a month and a half there is suppuration. If plates are applied see that it shall be on the least injured side.

Neutral soap solution (Leriche).—Castile soap, 2 kg.; hot water, 10 l. Dissolve by 12-hour contact; filter through double thickness of gauze, add glycerine and 250 c. c. of 90 per cent alcohol; and neutralize with boric acid.

Army Sanitary School No. 94.

ORTHOPEDIC TREATMENT OF FRACTURES

By Professor Leriche

SUMMARY

(Translation)

A fracture is really cured when the fragments of the bone are joined by a healthy callus and united along the diaphyseal axis, so that the muscles may have their normal play. Correct orthopedic treatment will assure this result.

The treatment consists in reduction and immobility.

I. *Reduction.*—Is it necessary? Study of the principal displacements that may occur at the site of the fracture.

(1) Longitudinal displacement—overriding of fragments.

(2) Displacement of fragments in different axes—angular deformity.

(3) Lateral displacement of fragments.

(4) Circumferential displacement of fragments (by turning on the long axis)—decalage.

How can reduction be obtained? Different sorts of reduction.

Surgical reduction—osteosynthesis. Its advisability.

Sudden reduction; its advisability. Exceptional method which can only be used when powerful muscles will not interfere.

Progressive reduction by continuous extension; choice of methods. Two methods are used; those that (a) act on the muscle; (b) act on the bone.

(a) Act on the muscle: Traction with weights by means of glued bands, as to leg or forearm. Traction with Hennequin's band.

The best rule is the following: Make the extension in the axis of the superior fragment and in the position which best overcomes the resisting muscles.

(b) Act on the bones: Nail extension. Methods of Steinman, of Codivilla, Finocchietto's stirrup. Traction with springs; Delbet's appliance and those derived from it.

Choice of a method: One must be eclectic. As a general rule, begin by traction with weights, by means of glued bands, and later, during the convalescence, use the spring appliance.

II. *Immobility*.—Its aim—to avoid pain; to avoid movements which disseminate infection. Principles of immobility and means of realizing it:

(a) A. Bonnet's principles. Fix the articulation above and below the site of fracture; splint, paillon, plaster of Paris.

(b) Immobility of the seat of fracture exclusively; osteosynthesis, Delbet's appliance.

(c) Immobility through suspension which overcomes the muscles and only allows the limb to be moved passively; American appliances, Hodgen's and Blake's splints, etc.

Which method must one choose?

It all depends on the fracture and on the moment when the method is applied. At all times of its evolution a fracture must be immobilized, but there are different ways of doing:

(1) An immediate immobilization for the time being, to go from the dressing station to the surgical ambulance.

(2) Another immobilization after surgical intervention.

(3) An immobilization for evacuation in the hospital train.

(4) An immobilization for orthopedic convalescence.

Different appliances must be selected for these different periods of treatment, as well as for each limb.

NOTES FROM LECTURE ON ORTHOPEDIC PRINCIPLES IN THE TREATMENT OF FRACTURES BY
PROFESSOR LERICHE

No fracture can be said to be cured until:

(1) The fragments are united by healthy callus.

(2) The axis is such that a normal strain can be borne.

(3) The muscles in connection with the fractured bone have their normal play.

There are two periods in the orthopedic treatment of fractures: First that of reduction; second, that of immobilization.

The difference between fractures usually seen in civil practice and the fractures seen in war is that the latter are more irregular and occur in any part of the bone. The muscles are torn as well as their attachments. War fractures are also much easier to reduce and give better functional results when properly treated.

Fractures between the supinators and pronators of the forearm cause, if unreduced, a period of forced pronation incapable of supination.

In fractures of the femur in its upper portion there is abduction and flexion of the upper fragment, with a forward or backward tilt (depending on the force which produced it, site, etc.), and adduction of the lower fragment.

Method of reduction.—(1) Open method. This is mentioned only to condemn it.

(2) Manual reduction with subanesthesia. Also a bad method. The only good results obtained have been where the bone is covered merely by skin and tendons, as in the region of wrists and ankles, and even here it causes much damage to soft parts if successful, which it often is not. It is exceptional, indeed, if good results can be obtained.

(3) Continued traction. This is the best. It can be secured by:

(a) Adhesive strips fastened to the skin and drawn upon by weights.

(b) Clove hitch on foot or wrist attached to weights. The principle of traction is to pull in the axis of the upper fragment, as the lower fragment is the only one over which we can exercise control. Therefore always bring the lower fragment in line with the upper and do not attempt the reverse.

(c) By direct pull on the bone (method of Steinman). This is accomplished by a pin driven through the condyles, to the projecting portions of which the pull is applied by cords, weights, and pulleys—or by the tongs, whose sharp points grip the condyles. Be rather careful of this method as the bones have suffered a reduction in vitality by tearing of nutrient arteries, hematoma, molecular shock, etc., and osteitis of the cancellous portion of bone is easily set up. The Scandinavians and recently the Argentinians have utilized a metal stirrup for fractures of the lower extremity (Finochietto's stirrup) which is applied to the heel. The main trouble with it is that it pulls in one position only.

(d) Separation of metal plates fixed to the limb above and below the fracture through two lateral metal threaded bars and thumb screws. Delbet's apparatus separates these metal plates by a spring tending to force the fragments apart, thus producing extension and counterextension and allowing the patient to get about early. It is a good device but does

not allow circulation to be cut off, and watch for ulceration where the epiphysis acts as a point of support against which the pressure is exerted. With a well-applied Delbet a patient with a fracture of the thigh can get out of bed with extension apparatus applied after 30 days. Even when the case is a bad one, the patient can get out of bed in from 40 to 80 days, and do his daily duties with the Delbet. But this apparatus should not be applied before the thirtieth day after the fracture; that is to say, it is an apparatus for convalescence. You can use it in fractures of the tibia and both bones of the leg, but the knee should always be immobilized. If only one bone is broken, use plaster of Paris and after 20 to 25 days Delbet. As a matter of fact, Leriche states that it is possible to use a Delbet 3 to 5 days after the injury, but he personally prefers the bed for his cases. He can not see the reason for this festination about getting a man on his feet before union has at least begun to take place and condemns ambulatory treatment of this sort. When both bones are broken he prefers extension by the Hodgen's or by a straight pull on the leg.

He states that the best way to prevent infection in compound fractures is by immobilization, and the surest way of touching off an infection of this kind is to immobilize too soon. The old principle was to immobilize the joint above and below the fracture. This principle is being superseded by the modern one of fixing the fragments.

(e) Immobilization by suspension, in which the body weight furnishes the counter-extension. This is the principle of the Hodgen and annuls the vicious effect of the muscular pull. Gutter, wooden and wire splints are all bad for femur and should never be depended on. The Thomas splint is excellent, but it should be only used for transporting a patient from the field of battle to the hospital where he is to finally convalesce. Here replace by a Hodgen. This is the best treatment in general. The clove hitch used in applying the Thomas must be carefully watched, as he has seen it cut through and bare the tendons when too tight or left too long without substituting glued strips to side of leg. He prefers the anklet. He is partial to plaster of Paris casts where possible to use them, and states that he knows no better way of getting a fractured thigh to the rear from an evacuation hospital, when this has to be done from military necessity before the normal time for such a transfer, than by making a plaster cast of the anterior surface of the whole lower extremity and making this continuous with a half cast of the belly, with infolding toward the flanks. Set this in place over the fractured limb and bandage over all. Thus the limb is suspended on a cradle of gauze bandage with an anterior immobile cast from which the limb is suspended, as it were. Such patients travel easily and safely.

Special fractures.—Humerus. Transfer to the hospital from the field with arm in a Velpeau reinforced by common splints. When he arrives and it is found that the deltoid abducts the upper fragment to put up at right angles to the body. If fracture is below the insertion of the pectoralis and the upper fragment is not abducted then, put it up in simple splints. He says here one may use the old gutter splint that fixes the elbow and shoulder. The Delbet apparatus here is painful and, in fact, it is not necessary to have any counter-extension in the axilla—simply suspend a weight from the elbow—800 gm. to 1½ kg. is enough.

Forearm: Here the worst results of ignorance are seen. If it does not unite there is muscular interposition. Put up in full supination. You will always provide this way for some pronation when the man leaves for civil occupations.

Thigh: These form the most serious of the fractures of war. Never use a gutter splint for them. As stated, the Thomas for transportation and the Hodgen afterwards is the proper treatment. In high fractures of the femur, abduct and bring traction on both lower extremities even if only one femur is broken, as if you abduct and extend only one the patient will unconsciously shift his position to ease himself of the abduction and thus destroy the alignment.

Fracture of the leg: Gutter splints may be used here, as they fix the knee, but should be used only to bring him to the hospital. Keep such a man in bed and use Hodgen. Plaster of Paris is no mean splint if split longitudinally after setting. In securing gradually increasing weights to get continuous extension, he calls attention to the ingenious device of hanging a pail on the traction ropes and adding water, a little at a time, to point of overcoming muscular rigidity.

NOTE.—The following statistics were handed me by a well-known French surgeon.

Statistics on primary suture of compound fractures due to war wounds

Bone	Number of cases	Sutured	Cured
Humerus.....	75	23	15
Forearm.....	81	19	14
Femur.....	43	3	1
Leg.....	73	13	9

Army Sanitary School No. 95.

TRANSLATION OF SUMMARY OF A LECTURE ON FRESH ARTICULAR WOUNDS

By Medecin-Major Leriche

Wounds of the joints in war are more serious than articular wounds in time of peace for the following reasons:

1. The projectile carries with it a fragment of infected clothing.
2. There often results an injury of the bone. Under these circumstances grave infections occur which it is imperative to forestall, on account of the difficulty of contending with them later on. There is but one method—the operative prophylaxis of all articular wounds, save those produced by a long-distance rifle ball with punctiform wounds of the skin, experience having proved that they generally run an aseptic course.

The period during which this prophylactic surgery can be practiced is rather longer than for muscular wounds. The synovial liquid retards the infection and the period of incubation is hence prolonged.

The basis of the prophylactic treatment is the immediate extraction (24 hours) of the projectile and of all foreign substances after excision of the traumatized tissue. The technic must be based upon exact knowledge of the anatomical type of the wounds, and the function of the limb must be kept in mind.

The principal anatomical types are the following: The simple synovial wound without lodging of the projectile; the synovial wound with lodgment of projectile; the synovial wound with a wound of bone; the synovial wound with fracture; the epiphyseo-diaphyseal splintering.

What course should be followed in each of these different cases?

I. *The simple synovial wound.*—Treat the wound as a flesh wound; that is to say, by complete excision (synovial edges included) and primary suture.

II. *The synovial wound with lodgment of the projectile.*—Three different conditions may occur:

1. The projectile may be near the orifice of entrance. In this case, excision; arthrotomy extraction of the projectile; primary suture.

2. The projectile may be on the opposite side from the point of entrance. Let us take the knee joint as an instance. You will first perform lateral arthrotomy at the point nearest the projectile; then excise the wound of entrance down to the synovial membrane. If you fail, raise the patella and bend the knee, examining the articular cavity. After cleansing, suture both sides.

3. The projectile is loose in the articulation or behind it. After excision of the wound, you practice lateral arthrotomy, and, if insufficient, the U-shaped arthrotomy (exceptional method). After extraction of the projectile and articular cleansing, suture the synovial membrane and the patella tendon very carefully, as well as the fibrous layers and the skin.

When the projectile is distinctly lodged at the back of the crucia ligaments, an incision in the popliteal region is preferable.

III. *The synovial wound with bone lesion.*—Practice the excision and arthrotomy as before stated. Respecting the bone lesion it is to be remembered:

1. That a wounded cartilage does not proliferate to repair a breach.
2. That a bone cavity does not fill by proliferation of its walls.

3. That a certain limit can not be passed if the articular function is to be preserved. Therefore, a small fragment of cartilage or bone can be removed, but if the cartilaginous wound is large, or situated in a groove, the articular function will be reduced.

If the removal of the projectile obliged you to create a cavity in the bone, the walls will have to be smoothed; if this is impossible, the cavity should be filled with a plastic mixture (bismuth or iodoform paste), or with a fat or muscle graft.

If the ablation of the lesions derange the articular function, the final result will prove unsatisfactory and primary resection is preferable. For example, if you remove a condyle of the femur, the result will be lateral dislocation of the knee.

IV. *The synovial wound with fracture.*—There are two methods to follow: (1) The removal of all loose fragments, followed by suture; (2) classic resection. Many surgeons think that the removal of all loose fragments should be done without troubling about functional result, but the results of resection are excellent, if practiced after the method of Ollier, which is based upon two fundamental principles:

First principle: The periosteum properly preserved produces bone.

Second principle: The capsule, the ligaments, and periarticular muscles mold the fresh bone and by their united movements create a new articulation.

To obtain this result, the surgeon must respect all tendons, muscles, and motor nerves. The periosteum must be kept attached to the capsule and ligaments; this will be possible by making use of a very sharp rugine.

Wonderful functional results have been obtained by surgeons who have faithfully followed Ollier's method—subperiosteal and subcapsular operations.

V. *Epiphyso-diaphyseal splintering.*—Extensive lesions may lead to important eliminations of tissue: One must learn to keep only the indispensable functional elements. Therefore, the technic will be different for an upper and lower limb.

The essential function of the lower limb being the support of the body, it is preferable to sacrifice bone, in order to obtain a better support and at the same time a painless one (for example; knee, foot).

The essential function of the upper limb being prehension, you must never amputate, what ever the anatomical condition may be; if you can preserve prehension, two fingers suffice.

NOTES ON LECTURE

Before this war these wounds were considered especially serious, particularly in agricultural regions, where bad infections took place, resulting in suppurative arthritis, the bogey of all military surgeons. This led to amputations. In fact, this outcome was so frequent that war wounds of this character brought about a policy of amputating above the injured joint immediately, without waiting for infection. The small punctiform openings into joints were considered to be favorable cases.

The reason why these joints were serious was that (1) the clothing was carried in with the projectile, and (2) the bone was injured as well as the joint, which brought about not only an arthritis but an osteo-arthritis.

Now we know that the synovial fluid has a deterrent effect on the growth of bacteria and that the interior of a joint is less liable to infection than the bone or the soft parts surrounding it. Hence to prevent these infections it is merely necessary to remove all foreign bodies and to accomplish a surgical prophylactic operation with removal of dead and devitalized tissue to avoid infection of the joint. In the old days we used a tampon in simple synovial wounds and drained those that were accompanied by fracture of the epiphysis. But now we do a primary excision and suture the joint first of all, following immediately, or a little later, when bacteriological examination has demonstrated that such closure is safe, by suture of the soft parts and skin. All work in a joint must be done gently, and extreme care must be taken that nothing of the projectile or clothing is left in the joint. As a matter of fact, Leriche indicates that one can leave a wound joint longer without operation than one can leave with safety a wound of soft parts and mentions the fact that he has gotten excellent results from primary and primary retarded sutures up to 24 hours after the injury. In suturing up synovial sacs, great care must be taken to secure absolute hemostasis, with ligation of all arteries. If not, there is danger of getting a bloody effusion into the joint which will furnish a favorable

medium for microbes always on hand to ruin one's work. As to the question of early mobilization of joints, Leriche states that Wilhelm's idea of mobilizing a joint early is nothing new. Cases of laparotomy have been early mobilized, but he says that he prefers to immobilize joints for 10 to 12 days and then begin movement. In this way he believes that one gets better results.

It is, above all things, necessary to preserve the statics of the joints, particularly in those of the lower extremity; that is, the laws of physics should be preserved. Also, in a knee, one can not make cartilage rub against bony tissues. He does not curet a damaged bone, but cuts away the contaminated portion just as is done in a primary suture of soft parts. When one does this the bacteriologist should at the same time make cultures by inoculating culture tubes with pieces of clothing, bone, and a few drops of bloody fluid. It was interesting in several cases to find that of the three elements mentioned the bone turned out to be the most heavily infected with anaerobes. It is necessary to make a distinction between wounds of bone and fractures, which latter should be interpreted to mean a solution of the continuity of bone. In a bone wound, where the projectile must be removed and the surgical sterilization of the cavity made, it may be possible to suppress the resulting cavity by smoothing away the sides enough to make a dimple, even smoothing it off flat. On the other hand, it is possible to fill up the cavity by Beck's paste if the cavity is sterile, or a small graft of fat or muscle can be used for this purpose, and this muscle graft will also act as a hemostatic. But one can not fill up the cavity of the epiphysis inside of the joint; that is to say, a cavity in the joint surfaces. Nor can one fill it if the cavity is very large. If the whole articular surface of the condyle is affected, it has to be removed. We must preserve the mechanism of the joint at all costs. For instance, if 40 kg. of weight is distributed equally between two condyles, 20 kg. on each condyle, the removal of one or the other will cause a dislocation, with a resulting genu varum or valgum. The same is true, but to a less extent, of the elbow. In these knee cases with hopeless destruction of essential parts of the joint, complete resection is advisable because, although a stiff joint results, the weight-bearing surfaces are not dislocated; the patient walks much better than he would with a weak joint, as the hip and ankle make up by increased motion for some of the stiffness of the knee. To this is opposed the opinion of some surgeons, who say that only a removal of the loose bone should be done, but Leriche believes that we should only remove bone in this manner when there is no resulting disturbance of the statics of the joint. That is to say, one can take out the head of the radius without disturbing the statics of the elbow joint or the condyle of the humerus, or the head of the astragalus, but not if the neck of the astragalus is affected, as function would be thereby disturbed; it would be better in the latter case to do an astragalectomy. Moreay resected joints in the first revolution and he had good results. Ollier shows that to get successful resections one must keep the periosteum with a thin bony layer adherent thereto to produce osteogenesis and also preserve with great care and without mutilation the capsule, ligaments, and periarticular muscles and tendons in order that they may mold the oncoming new bone and thus produce a functional new joint. Emphasis must be laid upon the fact that the incision must not destroy any tendons, muscles, or nerves over a joint, and the insertion of muscles must be retained in the capsule and ligaments, together with an ample blood supply. In order to accomplish this successfully we must use a very sharp rugine, and the best is the shovel rugine which he uses. This not only preserves the periosteum but conserves the continuity of periosteum with the capsule and all of its ligaments and tendons, which is just as important a part of the operation as any other.

The functional result in joint operations is much more important than the anatomical one. The upper and lower limbs have different functions; the leg is made to stand on, to walk on, and even at the expense of a stiff knee one should aim to get a painless, solid, weight-supporting limb. Do not resect a tarsus when a painful plastic scar is the result. It is better in such a case to do a Lisfranc operation. Use the heel to walk on if resection makes a painful stump. It is well to amputate above the knee if a resection is going to give a bad functional result. So much for the lower extremity.

The arm, on the other hand, is a prehensile organ and as long as we can save two fingers we should preserve it, even at the expense of a flail joint. It would be well in principle never to amputate if two fingers can be saved.

* * * * *

Comments on certain joints.—It is always better to do a bilateral arthrotomy than to cut the patellar tendon. If a resection of the knee joint is done, nail the femur to the tibia with an iron staple. Put up in plaster and do not allow walking for three months.

In destruction of shoulder joint the head may be resected, leaving the physiological periosteum. In this case the reproduction of bone is always sufficient for function. The position of immobilization is at right angles to the body with the forearm flexed.

If the projectile has lodged in the head of the humerus, passing through the cartilage, do a resection and sew up in 48 hours.

The reproduction of bone is so rapid in some cases that the callus must be even restrained by X rays to avoid permanently locking the joint.

Army Sanitary School No. 96.

DEMONSTRATIONS ON BONE AND JOINT INJURIES

By Professor Leriche, in his operating group, H. O. E.

The seance consisted of a preliminary talk on the general subject, illustrated by X-ray plates and stereoscopic X-ray pictures, and afterward a demonstration of skeletal specimens, and of patients themselves.

THE SHOULDER JOINT

It is always desirable to remove a lodged missile from the cancellous portion of the bone and the layer of bone in contact with it, filling in with a graft. When the whole joint is shattered, however, a formal resection is necessary. In one case shown he resected the head of the humerus, the head of the acromion process, and the outer end of the clavicle and still obtained a suitable joint with some movement. In such cases he removes all the fragments of bone and debris by subperiosteal resection, taking great care to preserve the continuity of the capsule and the periosteum without tearing. The end of the humerus is immobilized in the cavity. Five cases were shown with apparently good results.

In the first case shown the arm can be abducted to a horizontal level. He states that it is always better in such cases to do a primary retarded suture and to leave the wound open at least 48 hours, being guided by bacteriological cultures until safe to close. In the case in point, healing occurred in a month from the time the man was wounded. He was then given two months' leave of absence and was back to duty in three months. The charts of these cases show a normal course. You can generally figure on a month for healing in primitive suture and one to two months for complete convalescence. He states that a shattered joint that has been resected should never be moved for a month. In order to insure the immobilization of the lower fragment in the glenoid cavity, the arm is fixed to the side instead of at right angles from the body. (The cases shown do not give as great a range of motion as those we have seen that were ankylosed at right angles to the body. He seems to be more concerned about getting immobility and a solid ankylosis than movement as he fears a flail joint much more.)

THE ELBOW JOINT

He says that operations on the elbow joint are on the same principle as those of the shoulder. The first thing necessary is to obtain a minute radiosopic examination. He employs the scheme of plotting out areas, charted on a radiograph of a normal joint—that is to say, he charts the elbow joint as a map in order to localize the fragment. It is possible to remove certain parts of the joint without compromising its statics, such as the external condyle. The coronoid process of the ulna can also be excised without destroying the function of the joint, although whenever it is so excised there is apt to be luxation. He showed pictures of men with complete excision of these portions who had return of function.

The Interallied Congress has pronounced against a formal resection and states that we should only take out the free splinters, but he believes they have gone too far in pronouncing against formal resections in a general way. Leriche states that the removal of splinters

should be done only when it does not interfere with the mechanism of the joint, but that when that mechanism is seriously disturbed resection should be done. He has, however, seen results of resection that were worse than good ankylosis.

Can mobility and solidity of the elbow joint be obtained?

The answer to this is, Yes; if the periosteum can be kept intact and continuous with the capsule.

When the physiological periosteum and the ligaments are retained, a mass of new bone is formed so rapidly that the callus is apt to be excessive. The joint must be moved by the patient himself so as to take up early the normal function and thus bring about a reforming of the joint. Often in spite of this there is so much new bone that ankylosis may occur, even after complete function had apparently been restored. He states that complete resection of the elbow joint gave him in many cases, after six months or a year, perfect pronation, supination, and flexion, with marked solidity and mobility. Leriche prefers to keep these cases under his own supervision and not at a general physiotherapeutic hospital. He begins active movement 8 to 10 days after the operation, teaching the patient to use his own muscles, so that in 10 to 20 days he can hold his arm up without assistance. Massage is also given. At the end of two months there may be a period of immobility which makes it look as though the joint was going to ankylose, but by the end of six months things have loosened up and the final result is good. He emphasized the necessity for personal attention to these cases.

After resection of the joint by Leriche's technique, an anatomical restitution is gradually brought about, even to the formation of cartilage. If Ollier's method is strictly followed, the olecranon is reformed, but it may be two or three years before it unites with the main bone. This regeneration comes from a center in the biceps tendon. When the joint injury is confined to those parts which are not of functional value, such as the head of the radius, the head of the olecranon, and the external condyle of the humerus, we can remove such parts without fear of compromising the joint because they are of no functional value. But when the trochlear surfaces of the humerus or ulna are badly involved, a primary resection must be done. The arm should be put up in forced flexion and supination. Do not fear ankylosis; the thing to fear is a flail joint, and this does not occur in Leriche's practice. Never cut the triceps tendon, and use your rugine carefully to leave the outer shell of the bone in contact with the periosteum. It is of greatest importance to preserve the soft parts around the joint; more important than the conservation of the bony parts of the joint. Do not try to sew up at the completion of this operation. He does not use the Carrel-Dakin method, because he says it has no effect on the streptococcus, which is the only thing that he fears. Active motion should be commenced on the fourteenth day and continued to about the sixtieth.

X-ray pictures showed the regeneration of bone which had taken place. He says we should not be alarmed at the irregularity of the outline because these irregularities are all filled in with cartilaginous tissue, and the function of the joint is perfectly easy.

In his demonstration of elbow joints he stated that he does not believe in complete excision if it is possible to avoid it. He begins passive motion in 8 to 10 days and after 14 days the patient moves the joint himself to mold it. Only after six months it can be determined what amount of function the joint will have. He emphasized the necessity for a very clear conception of the anatomy of the part.

Incidentally in the course of this lecture Professor Leriche referred to attendant wounds of vessels and stated that no suture of arteries is ever done at the extreme front. The best thing is to put hemostats on firmly, note the same on the man's card, place on it a voluminous dressing, and send him in.

DEMONSTRATION OF PATIENTS

Case 1.—Reproduction of bone abundant, as shown by pictures. It was over-abundant and at the present time it has gone back to relative ankylosis, but movement will return. This should be looked up as a favorable thing, as excessive mobility is what we fear. He said this very man had a considerable amount of motion 2 months and 10 days ago, much more than he has now.

Case 2.—This was a shell wound of the elbow joint. Necessarily there has been a great deal of excision of the bone; nevertheless you can feel the bone which has been reproduced, and the sides have been filled up subperiosteally. He calls attention in this case to the necessity of preserving the triceps tendon which he considers important as it contains an osteogenetic center.

Case 3.—Wound of the elbow joint, received 15 days ago. We were unable to close this wound because the bacteriologist always reported the presence of streptococcus. The reason for this was that they didn't get hold of the case until the wound had become badly infected from handling and rehandling. These joints should be kept absolutely immobilized (he is always afraid of not getting a solid joint). After 14 days he wants the patient to move his arm himself. Movement need not be very extended as retarded movements are better than extended ones. They move the joint a little, every two days at first, then every day. He says the matter is very much simpler when you do not have infection and the wound is closed. The indispensable part of any resection is that the continuity of the periosteum (with its osteogenetic layer of bone) and its capsule be preserved.

DEMONSTRATION OF RADIOGRAPHS

These were all cases with complete resection of the elbow joints. He keeps all his patients here because if they are sent to other centers these joints are liable to be overtaxed. They all showed a considerable amount of regeneration of bone. He showed one man bearing a weight of 150 kg. from the injured arm; in this case there had been a complete resection of the elbow joint. He states that at the end of two months, when the motion of the joint becomes retarded from the overproduction of bone, he immobilizes it a while. It is at the end of six months that you will generally be able to see what the joint is going to be. He emphasized again that those are the injuries which require the constant, unremitting, personal attention of the surgeon. If that is not given, no amount of good operating or massage will prevent disaster.

THE KNEE

When the knee joint is opened it is not usually necessary to cut the patellar tendon, except in the very few cases where the missile has been lost in the wounded joint behind the crucial ligaments.

When the joint is resected it is necessary to fasten the tibia to the femur by an iron staple to secure immobility.

Case 1.—A piece of shell had lodged in the external condyle. The missile and the surrounding bone was removed, together with pieces of clothing. The wound was left open and three cultures were made—one from the cloth, one from the blood, and one from the bone. The cloth showed a few anaerobes, the bone many, and the blood was sterile. He left the wound open and mobilized the limb. After the fourth day he closed in two layers. The result showed both stability and mobility of the joint. This man received antitetanic serum before he reached the H. O. E. and again on the seventh and twentieth days.

Case 2.—This was a resection of the knee joint and a primary retarded suture, but in this case it was necessary to remove the silkworm gut sutures after nine days on account of infection.

When the iron staple is driven into the femur and tibia it is allowed to stay and the man is not allowed to walk for three months. If you do not nail these bones together there is a backward displacement of the tibia.

Case 3.—Previously sutured, but had become infected from the skin. The knee was opened and Carrel-Dakin solution used without result, except that a chronic synovitis was produced. Recovery will take place in time, with ankylosis.

THE HIP

Case 1.—Excision of the trochanter, neck and head of the femur by Ollier's method. The bone has regenerated enough to promise a good serviceable joint for weight bearing, if the man lives, which I doubt. In this case the joint cavity had to be drained and the cotyloid ligament removed, because if it is left it will die and be a source of constant suppuration. He demonstrated in this case the anterior plaster splints for moving patients with fracture of femur, referred to as ligature.

Gunshot wounds of the thigh are usually fatal. That's why he has no more to show.

BONES OF THE FEET

We should remember that the foot has three points of support, and the future of a member depends on the preservation of those points.

The os calcis: Fractures of this bone are common, but when the head is fractured, not only it but the whole astragalus must be removed.

It must be remembered that the periosteum of the bones of the foot has little power of regeneration; consequently you can not depend upon it. Make all incisions in the foot longitudinally and preserve all muscles and fascial attachments.

When Leriche removes the astragalus he dresses the wound about once every 30 days, because in this case immobility is an absolute necessity, and a moderate temperature for the first three days does not worry him. Clawfoot is due to contracture of the planter fascia, and is a common danger in wounds of the foot. It can be overcome by hyperextension of the toes when the foot is immobilized.

If it becomes necessary to remove the scaphoid or any two of the cuneiform, either a Chopart or a Lisfranc is done, as if the scaphoid alone is removed the foot turns inward, with loss of function. If the external cuneiform is removed the foot turns outward and function is lost, with painful scars as a result. The same thing applies with the metatarsals if more than one is removed. When you remove the lower ends of the tibia and fibula always remove the astragalus so as not to leave the square ends of the tibia and fibula in contact with the articular surface of the astragalus. As a matter of fact, if you do it will slide off the articulation and give deformity and pain. The bones of the anterior line of the tarsus may be removed and still give a useful foot except for ankylosis.

REMARKS ON PRIMARY SUTURE

This case had a retarded primary suture. His wound was received the other day and he was admitted in 14 hours. The wound was of the left shoulder and scapula, and was a large one. It was fully excised. The man shows some temperature, but Professor Leriche states that temperature up to 38° for the first day or two is not important; spontaneous pain in the wound is much more important. A slightly suspicious spot in the interior of the wound at the time of operation caused him not to complete the closure at that time. Another wound was closed systematically.

Case 2.—A large wound of the left gluteal region. This case shows an iodine burn due to the presence of a hematoma which predisposes to iodine burns, but it was closed nevertheless by primary suture.

Case 3.—This man came in 1½ months ago. The musculospiral was cut in two places and he grafted it with the nerve of a young rabbit. The patient is commencing to get nerve restoration.

The following cases were shown just before they were discharged on leave previous to joining their organizations:

Case 1.—Fracture of ulna. Primary suture. Returned to duty with excellent results.

Case 2.—Fracture of right femur—primary suture.

Case 3.—Fracture of the tibia. Removal of two splinters of bone.

Case 4.—Fracture of right radius and right tibia—primary suture.

Case 5.—Fracture of left femur and humerus.

Case 6.—Fracture of first phalanx, with involvement of joint.

Case 7.—Fracture of right femur—primary suture.

Case 8.—Fracture of right tibia near the patellar tendon—primary suture.

Case 9.—Fracture of the left tibia, with division of the posterior tibial artery—delayed primary suture.

Case 10.—Fracture of right shoulder joint.

Case 11.—Fracture of outer third of clavicle.

Case 12.—Piece of shell in the head of the radius in 1915. Returned for operation in 1917. Projectile removed and anaerobic bacteria were found alive in the bone.

Case 13.—Fracture of left elbow.

Army Sanitary School No. 97.

CLINICAL DEMONSTRATIONS, FOURTH SESSION, ARMY SANITARY SCHOOL

By Professor Lemaitre, at his operating group

His boxes of ordinary instruments for operations on the soft parts contain: 4 towel clips; 6 Péan's forceps; 6 Kocher forceps; 1 rugine; 1 eurette; 2 retractors; 1 pedicle forceps; 2 rat-tooth thumb forceps; and 1 director.

There are 3 of these boxes per table, 1 in the sterilizer, 1 being prepared, and 1 in use.

In addition each table had a separate one for Reverdin needles, another for scalpels, another for 6 pairs of blunt, straight scissors, another for 4 pairs of curved scissors.

He gave us quite a talk on the care of instruments and stated that he sterilizes his at 50° in a hot-air sterilizer for from 25 to 30 minutes; that the instruments must be perfectly clean, and that a coffee spoonful (5 gm.) of formaldehyde powder is placed in the bottom of the pan, covered over with gauze, upon which rest the instruments to be sterilized. It takes one attendant alone to look out for these sterilizers, and he devotes all of his time to it. Trioxymethylene is precipitated on the knives if overheating occurs. You need one hot-air sterilizer per two tables.

Although there is a central sterilizing plant at this hospital, Lemaitre prefers to sterilize his own sponges, which he makes of cotton covered with gauze, and they are small. He also sterilizes his own gloves and all instruments and his own operating gown, so that he can always be sure to have them. The water used in the operating group is sterilized outside. There was an ingenious pedal arrangement for washing the hands, the right foot turning on the soap solution, the left foot the water. Wash in sterilized water and soap, then alcohol, then dry with sterile towel; then put on gloves. Lemaitre states that he is not very fond of operating under X rays. He generally makes his assistant use the bonnet or has the radiologist in the room. He says there is too much tendency, operating under X rays, for a man to go straight to the projectile, instead of getting to it through the tract, with proper excision of the devitalized parts of the wound en route.

He prefers not to give ether by the closed method, as it cyanoses the patient, and thus influences the color of muscles to an extent as to confuse him in judging whether a muscle is alive or not. For these reasons he prefers the open method.

He does not believe that teams should operate longer than eight hours. During the first four hours they do excellent work, but he says he would not care to be operated on by the same team after that time.

Lemaitre says that he believes that the primary suture is going to reduce considerably the neurites of war.

He does not believe in antiseptics, but he does believe in early mobilization of joints.

Professor Lemaitre has in his operating group 8 tables—2 for fractures, 2 for injuries of the splanchnic system, and 4 for wounds of soft parts. Four are in one operating room and the others are in two's. Eight teams serve those tables in eight-hour shifts, and patients are prepared in a preoperating room with two preoperating tables to each operating table. These preoperating tables are simply litters with removable horizontal boards in the place of canvas and are placed on trestles. He always has the radiologist mark the position of the missile with nitrate of silver. Lemaitre considers that one X ray and fluoroscopic table will supply the data for three operating tables.

Professor Lemaitre took the class all through his wards, which were pretty nearly emptied of their patients in expectation of a big offensive. He nevertheless showed us 10 cases which demonstrated most of the phases in the technic of the primary suture. The first case was particularly interesting, inasmuch as it was a wound which was continually being opened and which nevertheless healed without suppuration.

Case I.—Multiple wounds with great shock—one penetrating the forearm, a wound transfixing the left thigh, a wound penetrating the right leg, and one in the axilla. In the last the projectile had entered the posterior fold of the axilla and had lodged in the pectoral muscles. It was removed by an incision from the front, débridement was done to the brachial plexus from front and rear openings, and the wound was closed. In a short while, however, there were evidences of injury to the median nerve and an incision was made into

the axilla with a view of examining the plexus at that point. Here the injury was discovered, remedied, and the wound closed; but on the eleventh day attention was again attracted to the wound by pain and a large hematoma near the wound in the rear. This was now opened and the posterior scapula artery was found bleeding. This was tied, the hematoma removed, the wound was closed, and the healing was complete by first intention.

Case II.—Demonstrated excellent results which might be obtained in dirty wounds involving the tendons of the hand. In this case the wound was caused by a shell which had destroyed the second and third metacarpal bones, severing the extensor tendons of the fingers corresponding. It was a primary delayed suture on account of shock; but the bones were removed and the tendons sutured; after 15 days this man had movement in his fingers.

Look out for spontaneous pain 8 to 10 hours after operation. In this case examine your wound right away.

Case III.—Wound of right ankle involving the outer malleolus, with lodging of projectile. Primary suture in eight hours and good result.

Case IV.—Three wounds on left thigh of leg due to grenade; primary suture and perfect result.

Case V.—Wound of right thigh; primary suture; infected; has to have secondary.

Case VI.—Extensive wound of the left thigh, perforating; secondary suture; result good.

Case VII.—Wound of right thigh; clothing carried in; gas bacillus. Immediate suture gave perfect result.

Case VIII.—Missile entered the back of the inner malleolus, cutting the nerve; primitive suture; perfect result.

Case IX.—Tangential wounds of the cranium in which the man was trephined to determine his actual condition. The dura was not injured and the wound healed by first intention.

Case X.—This was a perforating wound of the left thigh in which primitive suture was done, followed by abscess. This was due to the fact that the bacteriologist reported streptococcus and the wound was not opened in time.

Case XI.—This man came in seven hours after being wounded. One of the missiles had produced a star-shaped fracture in the trochanter. A primitive suture was done but a drain left.

CLINICAL DEMONSTRATIONS, FOURTH SESSION, ARMY SANITARY SCHOOL, BY PROFESSOR LERICHE, AT HIS OPERATING GROUP

A true bone injury is always much worse than the X-ray picture demonstrates.

He does not advise the curetting of bone for slight wounds, but uses the bone scissors. It is better to resect than to attempt to close a cavity in a joint surface where the pressure will afterwards fall.

In the after treatment of joints, make your patient use his own muscles; never permit passive motion.

After primary closure of joints you are apt to have an excess of synovial fluid. If there is much fluid, aspirate.

McEwen's scissors are used for trimming off infected splinters. If it is merely a slight abrasion of the bone it may be curetted and the wound sewn up. One of the greatest difficulties with a wound of bone within a joint is that these bones bleed a great deal.

Intestinal bacteria are the chief cause of infection in war wounds. Clothing is carried right into the spongy parts of bone. He demonstrated this to us in some pathologic specimens. Hence, the necessity for removing the contaminated parts of bone inasmuch as we have seen small pieces buried deep in the cancellous tissue. There is another point of view to be considered still, in the small macroscopic pieces of clothing, or exceedingly minute pieces that would escape ordinary detection with the naked eye. These are foci for future gas gangrene or tetanus, given a cause that will awake them from their latency.

When you are told that bacteria begin to multiply in a fresh wound after a certain time, remember that this time is relative. In his experience no considerable multiplication takes place until after the twelfth hour, but some go 18 to 24 hours without marked increase.

Leriche makes a great point of using retractors to expose a wound well, especially when one looks into a joint to search for foreign bodies. Wounds of bone are not often revealed by the radiologist, so when you open up the joint you can expect to find anything from a fracture to a small chipping of bone or cartilage. If there is a wound of bone and cartilage on an articular surface sufficiently extensive to compromise a condyle, then consider a resection. If an important condyle, as in a knee, is condemned by the injury to the bone and articular surface, rather than take it away, which would destroy the statics of the joint, resect the joint and fix the lower end of the femur into the head of the tibia by iron staples.

In the fifth class of joint wounds, in which the epiphysis and diaphysis are fractured, it may be possible that the joint has not been entered at all by the missile; in such a case do not open the joint but treat the wound of entrance.

Many surgeons believe that resections give bad results, but the reason for the bad results they quote is because bad methods are employed. His method of doing a resection of the elbow joint is to merely remove the cartilage and absolutely free fragments of bone; all other fragments are left. The synovial membrane is closed and the muscles and skin later by retarded primary suture. He immobilizes 10 to 14 days and then makes the patient move his own joint, movement which is kept up until after the second month. At this time there seems to be a retrograde process, which continues until after the sixth month. At the beginning of this retrograde process it is well to immobilize the joint for a while. It comes from overproduction of bone.

CASES

He showed a case with complete removal of the head, neck, and great trochanter of the left femur, seen here in January at the second session of this school. At that time it looked as if he were going to die. Ollier's subperiosteal method was here employed and there has been considerable regeneration, as can be seen from the X-ray plate; the man is walking with a cane and is pretty spry and healthy looking.

Ninety-eight per cent of long-distance bullets cause wounds which heal by first intention.

Army Sanitary School No. 98.

MALINGERING

By Maj. John H. W. Rhein

The importance of the study of malingering will be at once apparent when it is realized that it is recognized as one of the most active factors contributing to the depletion of forces and to inefficiency in war (Munson).

It is connected with the administration of the sanitary service in all its problems—primarily, as Munson has shown, in relation to insuring the retention of effectives, and relieving the fighting forces of noneffectives.

Munson in his paper shows how easy it is for a malinger, first, to get on sick report, then to a base hospital, thus separating himself from his regiment and, if transferred to the rear, from his division. Each transfer strengthens his position, as passing through a number of medical officers without a positive diagnosis being made, he has practically obtained repeated and official confirmation of his claims. Then he comes in contact with civilian relief societies who are swayed by the sentimental, and this adds to the apparent plausibility of his allegations. The next move is to secure a sick furlough, his last object to be accomplished, the "escape from any direct military oversight and control whatsoever." Finally, the last step is to get a discharge for disability with a pension, which at this stage is often not difficult with the long hospital records to show to the Government agent who is sent to examine him.

The study of malingering dates from time immemorial. In fact we may recognize in the mimicry or protective disguise of vegetables, plants and seeds, insects and birds, and animal life an analogy, and which Jones and Llewellyn have described as a reversion to a primitive biologic instinct.

The partridge trails a wing to deceive the approaching hound, and it is well known that certain animals feign death to escape danger. In all times, and among all social grades, instances of malingering or dissimulation are on record.

In biblical history you are all familiar with the acts of David who feigned senile dementia to evade Achish, King of Gath. "He scrabbled upon the gates and let his spittal fall from his beard."

Ulysses, in order to avoid leaving the arms of his bride, pretended to be insane. He harnessed an ox and an ass to a plow and scattered salt as though it were seed. His deception was unearthed with the soil he plowed, when Palamedes placed his son Telemachus in the path of the plow.

Self-mutilation was practiced by Pisistratus for the purpose of achieving a military end. He claimed that his self-inflicted wounds were received from the enemy outside the city gates of Athens and as a result of this deception he was given a bodyguard which he employed as a nucleus for developing troops with which he afterwards overcame the city.

Feigning illness was employed by the Greeks for the purpose of avoiding military duty, the penalty for which was death. The practice also existed with the ancient Romans, who cut off their fingers and thumbs to evade military service.

Aristophanes, so Plato informs us, feigned an attack of illness to escape replying to embarrassing questions, and the pupils of Plato padded their shoulders in imitation of his deformity, while Aristotle's pupils affected the lisp of their master.

In the sixteenth century the feigning of deafness, dumbness, and blindness by beggars was reported by Ambroise Paré.

In the medical literature, while Hippocrates mentions it, it was Galen who perhaps was the first to describe with care this condition. Its significance was recognized in the eighteenth century from a medico-legal standpoint, and the British military surgeons were familiar with its importance in the same century. In more recent years we find references to it in the works of Sir John Collie, who discussed the subject in relation to injury and McKendrick in relation to disease.

By the term pure malingering is meant the simulation of a disease which does not actually exist; the willful contracting of a disease by artificial means, or false allegations of symptoms not observed by the examiner. But there should be included in this discussion other conditions related and of much more frequent occurrence, for true or pure malingering, it is generally conceded, is of rare occurrence.

Allied to malingering and really of greater importance is simulation which includes the conscious and intentional exaggeration or prolongation of a real disorder (Ballet). This is by far the most common form of malingering. Roussy and Lhermitte subdivide malingering into that by (1) assumption, illustrations of which are the jaundice produced by pierie acid, dermatitis by vesicants and conjunctivitis by tobacco; (2) by invention, in which an objective disease, an abnormal attitude, a motor or trophic nervous complaint is created or there is complaint of subjective conditions such as pain; (3) by exaggeration, in which actual disorders, organic or functional, are elaborated; and, finally, (4) by prolongation, the persistence of conditions such as attitudes or symptoms the results of actual lesion after these are cured. The term malingering by fixation, for the latter two divisions, has been suggested by Sicard and Cantalaube. It has been aptly said by Joanny and Roux that malingering is intentional simulation, in contradistinction to hysteria, which is unconscious simulation.

Some observers have incorrectly believed that any morbid phenomenon in the realm of the nervous system when not organic signifies malingering. The importance of this phase of the discussion will become more apparent when it is realized that it is generally conceded that simulation can give rise to any condition which is seen in hysteria, for, as Babinski says, "Anything which is impossible for simulation is also impossible for hysteria."

It seems to be a matter of common experience that pure malingering is rare. Oppenheim found only 4 per cent among his cases of traumatic neuroses, and he believed that those who found it a common manifestation were lacking in knowledge of nervous diseases. Apropos of this, Kuhn stated that "the number of feigned lunatics seen by a physician is usually in inverse ratio to his psychiatric knowledge."

MOTIVES

Primarily self-preservation is the motive for malingering in war times. A study of malingering in the American drafted Army by Pearce Bailey showed that the motives of malingering are (1) to evade service; (2) to avoid duty; (3) to obtain service; (4) to obtain exemption from punishment; and (5) to obtain transfers.

(1) Malingering was not frequently seen in the National Guard nor in the Regular Army, in which enlistment was voluntary, and was more frequent in the drafted Army for obvious reasons.

The surgeon of the Columbus Barracks recruit depot classified the malingerers into, (a) those who applied honestly, primarily, but subsequently changing their minds either from homesickness or a belief that service might present hardships that they did not anticipate, and in which the deception was crude and easily detected; (b) and those applying with the deliberate purpose of being physically rejected. They thus could pose as decent men when they were really slackers and could use this to evade subsequent draft by showing physical disability. Such men are selfish and lacking in physical courage.

(2) Drug addicts and fake drug users employ this means to avoid duty.

(3) To obtain service, men falsify their ages. Epileptics, chronic alcoholics, and drug users conceal their disability in the hope of obtaining a livelihood which they can not obtain outside of the service.

(4) Often the malingerer will claim mental disease to avoid punishment when held for a general court-martial.

(5) In order to obtain transfer, some made complaints of their feet with the view of being transferred to the Quartermaster Corps, and timid men requested transfer to the Medical Department.

Suggestion which has been shown by Bailey plays an important rôle in the spread of certain types of symptoms. For example, flat feet are seen in companies. Lectures on disease have created complaints of the disease described by the lecturer.

Recruits from certain communities show a similarity of complaints:

Visits of special boards were followed by the appearance of certain symptoms, such as tremors after neurological boards, or flat feet after orthopedic boards. The past experiences of recruits color their complaints, such as visits to museums, quack advertisements, old wives' tales, misdirected sympathy of patients, statements of unscrupulous physicians (Bailey).

In civil affairs malingering is also practiced to gain money. This is illustrated in the beggar who affects disability in protean forms, and the industrial worker who claims damages for injury. Fear and timidity are shown by the conscientious objector.

Motives of personal advantage can often be traced, for example, cases in which malingerers who have claims pending for injuries received in civil life are on record.

Ignorance is the source in many instances. Many miners, mountaineers, and farmers of the Northwestern and Southern States are reported as not knowing why the United States is at war, or against whom. A number of the drafted Army are Germans or Austrians, or their parents are. The largest proportion are naturally timid, expressing themselves in evasion of responsibilities in civil life, among whom are the truants or runaway, or those who give up jobs when irksome, or those who are vagrants or who give illness as an excuse for avoiding their duty. Farmers are prone to become malingerers. In Quebec the provost marshal general reports as a result of the selective service draft law among the French that 12 in every 100 registrants from the agricultural districts filed claims, and that only 2 in every 100 drafted nonagricultural registrants filed claims. In our own mobilization, those of foreign birth were more apt to practice deception and those from the central and eastern parts of Europe more frequently than from the western parts. The ratio was: Jews, foreign, 5; Jews, native, 3; other (Italians, foreigners notably,) 2; Armenians, 1.

Among the northern negro, malingering is rare, to escape service. When present it usually vanishes when the recruit puts on his uniform, after which he appears to evade duty.

Nostalgia is an important element in the development of malingering. It was responsible for 5,266 during the Civil War. The depression acted as a fertile soil for the exaggeration of trifling ailments in the large proportion of the cases applying for treatment.

Malingering depleted the forces tremendously during the Civil War. President Lincoln said that to keep the forces at the front recruited up was "like trying to shovel fleas across a river."

A word as to the frequency of malingering. True malingering is rare. This is a matter of general experience. In 14 years in the German Army only 43 cases were reported, while in the French Army in 37 years there were only 308 cases. In the National Army camps the number has never exceeded 1 per cent of the command (Bailey).

Type of the individual.—Malingers may be divided into three groups: (1) Those of normal mentality; (2) the degenerate; (3) the hysterical (Dufestel); and (4) the weak-minded or insane (Jones and Llewellyn).

The malingerer of normal mentality is really a liar and cheat and is apt to be clumsy and unskillful in the presentation of his alleged disabilities, while the degenerate malingerer, usually of the criminal type, beggar or tramp, is more skillful.

The hysterical malingerer is, according to Babinski and Strumpell, a rank simulator.

Finally, the weak-minded or insane malingerer is usually of the criminal type who simulates insanity to escape punishment for his crimes.

Gleck's studies of malingering in relation to the criminal departments of insane hospitals lead him to the conclusion that when malingering is found it does not necessarily exclude the presence of insanity. They are often present in the same individual.

Malingering, being a form of mental reaction in an individual with the object of getting out of a difficult or stressful situation, is found in persons who are on the whole psychopaths, hysterics, and insane. Malingering is not always conscious behavior, but results from motives hidden in the subconscious mental life and affects, therefore, the individual's responsibilities for his acts.

Pearce Bailey described the simulators as being hypochondriacal or constitutionally inferior, who throughout their lives have never been able to meet disagreeable situations without complaint and ruse, deceit and evasion. The country malingerer is foolish, clumsy, grotesque, coming to camp with green spectacles, trusses, and alleging variocoele and hydrocele to be ruptures; pains in the back which he attributes to kidney disease; a sprain of the leg or a back sprain which he describes as paralysis.

Age.—Cases are on record in which children of 6 or 7 years of age have simulated diseases. Dufestel reported 76 cases in which the age was less than 16 years. The mature are more prone to malingering, however, and it is probably more frequent in women than men. It is not peculiar to any social class and is not more common in soldiers than among civilians.

Detection and disease simulated.—In diagnosing the condition one must study the appearance of the individual. The city malingerer is less apt to make his complaints specific and is cleverer at deception. The malingerer is disconcerted at intense scrutiny and if he suspects detection, blushes or tries to hide his confusion by turning his face, or averting his gaze. His manner may be brusque or blunt in an effort to be simple and honest, and he is inconsistent, he overacts, is given to generalities, pain of which he complains is always severe and is uninfluenced by treatment. He is cunning, crafty, and talkative. His complaints are not concrete, are vague, rarely localized, and always severe. He exaggerates and affects symptoms which are inconsistent with the disease he imitates. Objective signs are wanting and nutrition is undisturbed.

To detect a malingerer requires, beside accuracy in diagnosis, an understanding of human nature and character.

The usual tests employed in diagnosis of disease are usually sufficient to unearth the deception except in cases of deafness and blindness, when special tests are required. A brief stay in a hospital usually suffices to clear up the situation.

In studying the type of the individual one should familiarize himself with the condition in the community from which the recruit comes, for his motives are usually linked closely to his domestic environment. Study the family relations; the school record, the industrial career, why he chose his vocation, what his economic history is, his social adjustability, whether he has ever deserted women dependent on him, if for him the world is a good place to live in and, if not, why not, and finally his views as to war, the rights of the individual (Bailey).

Motives must therefore be searched for. One must examine into whether the condition presented as to suffering and disability is consistent with the result of the examination. Are the feet calloused when pain in the leg is alleged, or is the palm of the hand when it is claimed that paralysis of the arm is present?

Appeals to manliness should be made, references to fraudulent enlistments, threats of court-martial or of a disagreeable duty; and statements that the complaint is not a disqualification should be resorted to (Bailey).

Surprise, ridicule, irony, satire, and efforts to induce shame or fear may be employed. The attitude of the medical expert should be friendly for the most part and aimed to obtain confidence. In the examinations, look for suspicious features in the relation of the story, such as excessive anxiety, remarks to sidetrack objection, inconsistencies, and vagueness.

Sometimes Bruns's method of suggestion may be useful; i. e., to give the impression that the examiner suspects or knows that deception is practiced and then prescribes in an oracular manner a remedy, whereupon the malingerer usually confesses.

Hysteria.—Since the malingerer frequently simulates conditions in common with hysteria, it will be useful to discuss this in some detail. Hysteria in a malingerer who does not lie (Bonnal). The hysteric is an involuntary malingerer (Mereier). The manifestation of malingering and hysteria are alike in many instances (Babinski).

The old conception of hysteria is that it is manifested by (1) stigmata and transient disorders. Among the first are anesthesia of the pharynx, hemianesthesia, unilateral diminution of the acuity of special senses, such as concentric diminution of the visual field, diplopia or monocular polyopia and dyschromatopsia; and finally areas of sensitiveness to pressure.

The second includes convulsive phenomena, paralysis, spasms, mutism, glossolabial hemipasm (Chareot, Brissaud, and Marie) Astasia-Abasia (Chareot, Rieher, and Bloq) rhythmic chorea, erythema, vesicles, bulle, hemorrhages, ulcerations and gangrene of the skin, subcutaneous edema, laryngeal paralysis, spasms and edema of the glottis, pulmonary congestion and hemoptysis, gastric ulcer, hematemesis and melena, anuria, hematuria, albuminuria, angina pectoris, tachycardia or bradycardia and high fever.

Suggestion auto and hetero, but more especially emotion are the principal factors which prepared the soil and were able to give rise to hysterical manifestations without the intervention of consciousness or the interference of will. The modern conception of hysteria, on the other hand, as formulated by Babinski ascribes the fundamental characteristic of the hysterical manifestation to the curability by persuasion, and he suggests the name "pithiatism," which means "I persuade to be cured."

Hysteria is a pathological state manifested by disorders which it is possible to reproduce exactly by suggestions in certain subjects and can be made to disappear by the influence of persuasion alone (Babinski).

He admits that physical commotion and moral shock may diminish the personality, weaken the critical sense, and increase the suggestibility and thus play an important part in the development of pithiatic disorders. Emotion can not cause pithiatic symptoms itself. A suggested idea is required though supported by systematized affective states. This is a brief outline of Babinski's presentation of the so-called modern view of hysteria.

The old conception credits hysteria with any form of nervous disease, but Babinski concludes that it can not reproduce certain characteristic phenomena of organic paralysis. Vesicles, ulcerations, cutaneous hemorrhage, and the like are "nothing more than a legend."

Certain tests to differentiate between organic and hysterical diseases will be found to be useful in detecting simulation. The contractures or paralysis of hysteria are variable, modified from moment to moment, or day to day, and the resistance is intermittent. With blindfolded subjects presenting contractures of the hand, for example, repeated synchronous movements with both hands vary in amplitude and form, which is untrue of organic contractures. Transitory disappearances of symptoms is characteristic of hysteria. A paralyzed limb of organic origin drops lifeless, while in hysteria the limb is sometimes retained in the position placed by the examiner before it is relaxed. In lifting an organically paralyzed limb there is always the sense of weight given, while in hysteria it will be liable to variations and may for some time disappear entirely.

In contractures, the tendon can be seen to stand out as the examiner approaches and disappears as he leaves. When an unexpected examination is made of a limb the abnormal position is sometimes reduced without using any force. Babinski's diagnostic signs to distinguish between hysterical and organic paralysis are well worth reviewing.

In hysterical hemiplegia the paralysis is not apt to be limited to one side, is sometimes systematic; does not affect the unconscious voluntary movements; the platysma sign and combined flexion of the thigh and trunk are absent, the tongue is often deviated in a pronounced manner or to the opposite side of the paralysis, there is no muscular hypotonus,

facial asymmetry being due to spasm; the sign of exaggerated flexion of the arm and the sign of pronation are absent, the tendon and bone reflexes show no change; and there is no ankle clonus; the cutaneous reflexes are not affected, the abdominal and cremasteric reflexes are normal; Babinski phenomenon is absent; the reflexes of defense are not exaggerated; the form of contracture may be reproduced by a voluntary contraction of the muscles. The course is capricious; the paralysis may remain flaccid indefinitely or may be spastic from the first; symptoms subside and grow worse suddenly; they modify their intensity and form and present transitory remissions.

Reflex contractures and paralysis.—These are distinguished from organic monoplegias, in that, in the former the paralysis involves usually the fingers or foot and rarely the whole limb, remain usually flaccid for a long time, and are frequently associated with contractures, the hypertonus and the hypotonus occupying different muscular groups. In contractures the appearances are of the type described as *main d'accoucheur*, holy water vessel hand, and crowded fingers. In the leg the patient never circumducts, the leg is walking. The reflexes are not usually exaggerated, the cutaneous reflex, however, may be lost, but it reappears after the foot has been warmed. The Babinski phenomenon is never present. Atrophy never reaches that of neuritis and no reactions of degeneration occur.

Reflex contractures are characterized, in contradiction to hysteria, by resistance to treatment, absence of any natural attitude in hypertonic form, amyotrophy marked and rapid in development, marked vasomotor and thermal disturbances, marked hyperidrosis, exaggerated tendon reflexes, marked hypotonus, mechanical muscular hyperexcitability often accompanied by slowness of the contractions, rapid development of fibro-tendinous and trophic bone, hair, and skin disorders.

The symptoms in favor of organic disease, and never present in hysteria in the ocular sphere, are (1) lesion of ocular nerves, nystagmus, pupillary disturbances, persistent hemianopsia; (2) in the motor sphere, degenerative changes of muscles, single nerve palsies, and atrophies (facial or peroneal); (3) in the sensory sphere, anesthesia in the area of the distribution of nerve trunks; and (4) in the reflex sphere, absent knee jerks, ankle clonus, and persistent incontinence of urine and feces (Babinski, Oppenheim, and Leri).

One should be familiar with Sachs and Freund's test for deltoid paralysis. When the individual lies prone on a table so that the arm hangs down by side, he is then asked to raise the arm to his hip and then he is told to remove his arm from his hip. If he can not do this he is a malingerer, for if left to itself the arm would automatically, by the effect of gravity, drop to the vertical.

Malingering as to pain.—The behavior of the individual suffering from actual pain should be studied. Pain when present, if paroxysmal, causes the eyes to stare wildly, the brows to knit, the nostril to dilate, the teeth to clench, sweat to appear on the face, a modification of the pulse rate and respiration. If prolonged there is depression or prostration, pallor, fainting, insomnia, anorexia, and effects on the general health are manifested.

Flat-foot pain disappears when lying, and pain from varicose veins, worse when standing, is helped by rapid walking. Syphilitic pains in bones are worse at night. Look for defensive attitudes in joint diseases or as seen in torticollis, scoliosis, sciatica, and the psoas abscesses.

Search for objective manifestations such as heat, redness, and atrophy in joint cases or functional derangement of an organ when disordered functions are claimed.

Eliminate the possibilities of actual disease. Is the pain along nerve distribution; are there tender areas along the nerve; is the location vague? Does the pulse increase when pressure over alleged painful spots is made (Mannkopf-Rumpf sign), or do the pupils dilate, the face flush, and the pulse and respiration quicken (Bechterew's sign)?

Pain in the back is usually referred to the lumbar or lumbo-sacral region. It is necessary to eliminate the presence of movable kidney, renal calculus, prostatic disease, osteomyelitis, and spondylitis. Search for a history of possible strain to the psoas or anterior spinal ligaments, rupture or strain of the lumbar or gluteal muscles, the posterior spinal muscles or ligaments, or finally strain of the sacro-iliac ligaments. Resort also to skiagraphy in these cases.

Make various tests for mobility of the parts. Is there rigidity, does the individual bend forward without leaning to one or the other side? Does he walk cautiously and grope, or does he sit down carefully, and support his body on his thigh in rising?

In simulated scoliosis, the curve is in the dorso-lumbar region, is single, and lacks compensatory deviation; both sides of the thorax are equal; there is no deviation of the sternum; there is no torsion of the vertebra, and the curvature disappears during sleep.

Pain in the leg.—It is essential here to eliminate sciatica, sacro-iliac strain, flat foot, intermittent claudication, femoral thrombosis, syphilitic periostitis, and malignant disease of the bone. When pain is referred to the joints, search for stiffness, weakness, and limitation of mobility. The most puzzling cases are those which show no objective disturbances. Is the stiffness a voluntary restriction of movement? If the restriction is in some particular direction, or if the resistance to movement is continuous from the beginning and does not intermit and involves the whole limb, we have the picture presented by simulation.

Examine for atrophy, changes in electrical reactions, and reflexes, the presence of callosities, and make bilateral comparisons of strength.

In strenuous movement of the proximal joints against resistance, the distal joint or joints are fixed, so when this is absent one knows that the person is not using all his strength and therefore his weakness is simulated.

In moving the arm upward in abduction the malingerer raises the arms in a backward direction which is opposed to what happens in actual painful conditions where the arm is raised in a forward position.

If he claims not to be able to lift his arms above his head, let him place his arms on a chair lightly in front of him, at the same time bending the trunk forward. Then under guise of examining the back, gradually draw him away from the chair and the malingerer will allow the arms to remain over his head and thus his deception is unmasked.

Test for tremors.—Fuchs's test is based on the fact that it is impossible for an individual to make two simultaneous movements which counteract each other with the right and left arm or with an arm and a leg except after long practice. If the arm or hand is outstretched and the other traces crosses, letters, or circles in the air, the tremors become interrupted in the other arm by the voluntary movement, in the case of the malingerer.

Sciatic pain may be due to malingering or sciatic neuritis or neuralgia. In neuralgia of the sciatic nerve, the pain is dull, more or less constant over the distribution of the nerve, with occasional paroxysms; movement increases; habitual flexion of the knee and hip is present to relax the nerve; there is a compensatory scoliosis; and tender spots are present over the lumbar spine, posterior iliac spine, sciatic notch, popliteal space, peroneal nerves below the head of the fibula and behind the malleoli.

In neuritis the sensation is blunted, there may be electrical changes, muscular atrophy, lowered temperature, and diminished ankle jerk. Laseque's sign is positive, consisting of pain on flexion of the thigh and extension of the leg.

In Neri's sign, when the trunk is bent forward the knee is flexed. In Bonnet's sign, there is pain when the thigh is adducted.

Anesthesia.—In normal sensation, if two parts of the body are touched and pricked at the same time, only the prick is felt. In true analgesia only the touch is felt if the anesthetic area is used for the prick, while the simulator does not feel the touch.

One should be familiar with the Weber's test for sensation. He has pointed out that in health in the mid-sacral region the compass points are recognized at 1.5 inches apart, in the mid-lumbar region 2 inches, and in the mid-dorsal region 2.5 inches apart.

In testing painful or anesthetic areas, sensation should be tested first with eyes open and the area marked and then with eyes closed, remarking. If great variations are found, simulation is inferred.

The zigzag test as suggested by Captain Cuplin, R. A. M. C., is useful. After testing the upper limits of the anesthesia, start again approaching the line in a zigzag manner, when in fake anesthetics the level will be found to change. This is based on the confusion which is created in the mind of the individual by this test.

Also with the eye closed, test by starting on a sensitive area and ask the individual to indicate when the anesthetic area has been reached. Anesthetic areas may be also localized by drawing a pin over the surface, beginning over the anesthetic area and passing beyond to the sensitive area with the eyes closed, observing when the defense reflex occurs. At the moment the pin point is passed over to the sensitive area the patient winces.

Cardiac disease.—In testing for simulated syncope, it is merely necessary to review the symptoms of true syncope. These are: (1) Period of faintness preceding unconsciousness; a period of insensibility; a period of recovery; (2) feeble pulse and suspended respiration; (3) unconsciousness, rarely total accompanied by reflex loss; (4) short duration; and (5) subsequent pallor and sweating.

Palpitation or arrhythmia may be simulated by the excessive use of coffee and tobacco.

Rhinitis has been simulated. For example, there are on record cases in which ozena has been simulated by introducing into the nostrils a piece of sponge saturated with offensive smelling substances.

Epistaxis has been caused by introducing blades of straw or a piece of lead pencil into the nostril or injuring the mucous membrane with the finger nail.

Hoarseness and cough has been simulated.

Tuberculosis has been simulated by substituting tuberculosis sputum from other patients, or faking the presence of blood in the sputa.

When pleural pain is complained of, the absence of the physical signs and fever will clear the diagnosis.

Pneumonia has been induced in some cases. Sand cites a case of a soldier who enveloped his neck and chest for two nights with linen saturated with ice water, provoking thereby an attack of pneumonia from which he died.

Simulated dysphagia may be discovered by the introduction of a bougie, and observing the absence of disturbance of nutrition. In cases of vomiting, search for the presence of gastric ulcer, nutritional disturbances, and hysterical manifestation.

Hematomesis is commonly simulated to obtain discharge from service and is faked by swallowing animal blood or by blood from self-inflicted wounds of the nose or limbs. A study of the nutritional condition is helpful in such cases.

Tympanites is produced by swallowing air. Military boards describe instances of swallowing chalk and vinegar to bring this about.

Diarrhea has been simulated by taking cathartics.

In intestinal pain simulation, diagnostic measures should be exhausted to eliminate actual diseases.

In alleged incontinence of feces, test the sphincter, which should contract on the finger in the absence of actual disease.

Hemorrhoids are frequently faked by cavalrymen, who insert into the rectum bladders of rats or intestines of sheep. (Ambroise Paré and Fallot.)

There is on record instances of simulation of ascites in the British Army. Forty troops were admitted to the King's Infirmary said to be suffering from dropsy and intermittent fever who presented arching spine and who maintained the distention by short respiration. Actual injection of water into the peritoneal cavity was done by French conscripts.

Epidemics of jaundice are reported among the French troops which puzzled the medical officers until it was discovered that yellow pigmentation of the skin could be produced by the ingestion of picric acid. Chemical tests disclose its presence in the urine and clinically an absence of the typical colorless stools. The slowness of the pulse and itching associated with jaundice and the urine which does not contain bile pigment are the methods employed to detect this species of fraud. White of egg has been mixed with urine or even injected into the bladder. Imitators overstep the mark by introducing quantities incompatible with the state of health presented by the subject. Sometimes the subject has a little egg albumen in his pocket into which he dips his finger and smears the meatus with it, so that when he urinates, the urine washes off the albumen into the collecting vessel.

Edema is simulated by injecting water beneath the skin. Paraffin or turpentine causing fixation abscesses, usually situated on the inner aspect of the lower limb, have been employed by simulators, the complaint being phlebitis.

Hydrarthrosis of the knee joint has been simulated by placing a potato in the popliteal space and flexing the joint for a few hours forcibly, and swelling of the feet can be brought about by tying the puttees too tight.

Dumez, technical assistant of the Hygienic Laboratory, United States Public Health Service, reported a list of the drugs, chemicals, and septic materials used to simulate disease. Skin diseases such as erythema was simulated by nettles, poison ivy, squills; eczema, by croton oil, sulphur, acids, oil of cade, ointments of mercury or mezerium bark; impetigo, by cantharides or ointment of tartar emetic; other eruptive diseases by iodides, bromides, arsenic, or mercury taken internally and the use of phenol, cantharides, mustard seeds, or croton oil externally.

Ulcers have been simulated by potash or soda lye, sulphuric acid, or a strong solution of zinc chloride externally.

Abscesses are commonly produced by inserting beneath the skin a thread smeared with tartar from the teeth, saliva, or fecal matter.

Phlegmons have been caused by gasoline, kerosene, oil of turpentine, or a solution of chloride of lime injected hypodermically.

Lipoma has been simulated by the injection of paraffin.

Edema of the hands and feet has been caused by friction between the fingers or toes with a stalk of a species of horsetail (*Equisetum arvense*).

Simulation of diseases of the eye.—Inflammatory conditions have been induced by placing under the eyelid, ipecac, castor-oil seed, cantharides, lime, silver nitrate, red mercuric oxide, copper sulphate, acid lotions, urine, fecal matter, and putrid matter.

Mydriasis is brought about by the use of belladonna, hyoseyamus, and stramonium preparations.

Myosis has been simulated by the use of lobeline.

Diseases of the ear.—Otitis has been caused by inserting into the auditory canal, urine, feces, and chemicals.

Tonsillitis has been simulated by using irritating gargles, and hemoptysis by coloring the sputum with earmine or beef juice.

Gastric disturbances have been faked by swallowing oil and tobacco mixed together.

Diarrhea has been simulated by taking purgatives, by diluting the feces with urine or water, or adding pieces of meat or pork fat to simulate dysentery.

Icterus is imitated by liquid preparations of curcuma applied externally or picric acid internally as mentioned above.

Disease of the circulatory system.—Rapid heart has been induced by chewing cordite, which is a mixture of guncotton and vaseline.

Disease of the kidneys.—Sodium chloride and milk consumed in large quantities is used to cause albuminuria, and albumen has been injected into the bladder for the same purpose.

Disease of metabolism.—Diabetes has been simulated by taking phloridzin or ammonium oxalate or injecting glucose into the bladder.

Fever has been induced by inserting into the anus a peeled tooth of garlic and allowing it to remain 24 hours, or by the same crushed and rubbed into the axilla.

Hernia has been simulated by paraffin injected into the scrotum.

My experience in Camp Travis, where about 40,000 men were examined or surveyed and where, as a member of the special board of medical examiners, I was able to see all the cases of Malingering, the most common type consisted of those whose complaints were exaggerations or perseveration of symptoms which originated in an injury more or less severe some months or years previously which gave rise to habitual attitudes or limps similar to those described as occurring after so-called shell shock and now described by Babinski as reflex disorders or physiopathic disorders.

The limps were of very common occurrence. Some walked on the outside of the foot, due to a contraction of the anterior tibial muscle; or on the inside of the foot, due to contraction of the extensors and peroneal muscles; or on the toes, a flexor contracture; or some walked with bent knee with a list to the same side. Complaints of rheumatic joints were common, claiming restriction in the movements of the joint which were palpably exaggerated.

Fake sciatic cases were frequent, as were also contractures of the trapezius muscle, the sterno-cleido-mastoid, or all of the posterior group of neck muscles. The bent back, the camptocormia or plicature of the French was occasionally observed, also contractures

of the arm, hand, and wrist. In fact, an observation which I was able to make as a result of my studies in camp, in the French hospitals, and in the British "shell shock" hospitals, as well as among our own soldiers subjected to shell fire, is that many of the nervous manifestations are presented by the drafted men in training camps, though in a minor degree, as is observed in the soldier on the firing line who has been under shell fire and who presents disorders referable to the nervous system. In other words, the phenomenon of war neuroses observed among the French and English soldiers and seen in the American forces correspond in a miniature form to those nervous phenomena seen in training camps among drafted men upon their admission to camp or after they have been under training a short time.

Army Sanitary School No. 99.

NOTES ON THE H. O. E. WHICH WAS THE HEADQUARTERS OF THE FRENCH FIELD SERVICE SCHOOL FOR MEDICAL OFFICERS, MADE ON OCCASION OF THE SECOND SESSION, ARMY SANITARY SCHOOL

This hospital is situated in a broad valley near a large château and on the edge of a forest, about 12 km. from the line. It is reached by a spur of railroad from the station about a mile and a half away. There are no military works of any kind in the immediate vicinity of this H. O. E. and there should be absolutely no excuse for bombing it. It has nevertheless been bombed in a most destructive way, for which there is not an atom of excuse.

The plan of the hospital is a poor one, but this is by no means the fault of any of the medical staff nor even of the French Medical Department, as the hospital has been thrown together hastily and from military necessity its plans had been several times changed during the course of its construction. When it was first built a large hospital was not contemplated, and the extension of the buildings was made hastily and cheaply. Less than a year ago it had only 30 buildings. It is by no means poor, but it can not be taken as a model, or even as a type, of institution of the French Medical Department, as it is surrounded in every direction by hospitals of similar size and scope which are infinitely better.

In many ways the institution is a great credit (1) to the medical officers who administer it, and (2) to the French Medical Department, for a success has been made where it seemed impossible; the hospital is not only provided with the most advanced medical and surgical necessities but it is well administered in spite of its manifest defects.

It fronts on a wood and is approached by a semicircular drive near the center of the hospital grounds. All of this open space in front is parked and filled with flowers in summer. Here is the main office of administration, in front of which are three flagstaves—one for the Red Cross, another for the French, and another for the American flag. To one side of the building is the triage, a group of four buildings, described elsewhere.

The patients in this hospital are sent from three main points: 1, —; 2, —; and 3, —. In all, the hospital comprises 140 buildings, with accommodations for over 3,000 patients; this could be expanded to 4,000. They were Adrienne huts. Lack of funds has prevented the building of hard roads, and the walks are of duck board. As the site was very muddy, intercommunication was difficult—in fact, the terrain itself is damp and cold.

On the edge of the woods near by are kept from 18 to 30 motor ambulances; the number is not fixed, as they are sent here according to necessity. They are of the usual Fiat type, capable of handling five litter cases; they have solid metal wheels and solid tires, with an extra wheel in case of accident. The rear wheels are doubled. They showed evidence of hard usage at the time of this visit. The hoods of engines are kept covered by woven straw mats to prevent freezing. While rapid and seemingly efficient, their complete boxing in has been responsible for cases of CO poisoning. In fact, some of our party experienced the ill effects of this gas—not to a serious extent, however. There is no center aisle; it is taken up by an iron rack on whose bars run pulleys for the adaptation of litters. This ambulance is far too contracted and can not be said to be a model for our Army.

Behind the administration building is a long walk running the length of the hospital, connecting its two extremities, and along this walk are placed the administrative offices of the school, some of the lecture halls, some of the dormitories, and at the far end, to the left, the officers' dining room and library; beyond, on the right, are the two operating groups, one of Leriche and the other of Lemaitre. In the center are the nurses' quarters and, to the left,

evacuation wards, and still farther back are the evacuation wards, another lecture hall, and two enormous Bessonneau hangars. One is used as a theater and the other for wounded to be evacuated from Leriche's and Lemaître's operating groups. Just beyond this is the spur of the railroad, already referred to. The following buildings can be specially noted: Administration buildings, four buildings for triage, dormitories for visiting medical officers.

The two operating groups connected by covered ways with their wards, described elsewhere.

A building devoted to offices for the commandant and professors of the French school.

Two very well-equipped laboratories, one bacteriological and the other pathological.

The dormitories for visiting officers connect with a large lecture room in the same building. The commandant of our school and the instructors accompanying him were quartered very comfortably in this building, each room having a small stove, comfortable iron bunk, abundance of bed linen and cover, writing table, and electric light. The entire hospital is well lighted by electricity from a central plant.

Both of the laboratories are conducted by personnel of the Institute Pasteur, and the character of the work done is in accord with the international reputation of that institution.

The wards for hospitalization connected with the operating groups are served, each two, by one female nurse, and each ward contains but one type of injury. There is a service for injuries of the soft parts, one for chest wounds, one for genito-urinary surgery, etc., and each service is presided over by a chief who has upon his staff some excellently trained assistants as ward surgeons.

All parts of the hospital grounds are connected by a narrow-gauge railway which is used chiefly for delivering supplies.

The inherent defects of the hospital, lack of hard roads, mud, and hasty construction, together with lack of adequate supplies and a natural desire to spend more on more perfected hospitals, has made it most difficult to compete with the excellent, well-situated, well-supplied hospitals in its vicinity.

Histories are apparently complete; charts are hung at the foot of beds. In quiet times surgeons from the field ambulance and regimental organizations at the front are sent here as students and are not only allowed but required to do operative work as part of the course of their instruction, under the chief of the service to which they are assigned.

This hospital does not at this time receive head injuries, gassed, mental, or venereal cases. The abdominal cases are held, usually, at more advanced organizations for operation; the others are sent back to ——— or institutions in its immediate vicinity.

The nurses here are volunteers; they have received their instruction during the war and are not graduates. Anyone who has watched their work could see what a waste of valuable personnel it would be to exclude such a nurse, trained in time of war in an institution like this under the highest type of professional men, from exercising all of the duties and from having all of the perquisites of her profession simply because she has not previously received a diploma.

Antiseptics have practically vanished from this hospital, and all the time we were there we did not see a single case being treated by the Carrel-Dakin method. They consistently believe that such treatment is not necessary, preferring, exclusively, surgical prophylaxis. There was a ward set aside for cases of streptococcus infection and we were shown one case of six weeks' duration that had never had an antiseptic dressing (gunshot wound of the leg). Aseptic dressings are applied here on the theory that all infections are self-limited and the only weapon we have against the existence or the progress of such infection is auto-vaccination, which should usually occur in from 3 to 21 days. The streptococcus is the only microbe they fear; and as no safe antiseptic has any action upon this, none was used.

Another peculiarity of this hospital is that Thomas splints are not used while patients are under treatment here, as it is claimed that the pressure of the ring causes a great deal of pain and discomfort. They use several other forms of splints and plaster. We saw several put up in Delbet ambulatory apparatus. Lemaître made the statement that there had only been three cases of streptococcus infection in his six months' service in this hospital, and all were due to the fact that owing to the condition of the patient the wounds had not been sufficiently inspected at the time of the operation. All wounds are radiologically and bacteriologically handled before operation.

It is proper to especially mention that the buildings in the operating group are pleasant, cheerful, clean, warm, and well lighted. To heat them, a special central heating apparatus is provided. The operating rooms are painted with white enamel paint. They are large and very simple and all contain tables for operating under the X ray. Professor Lemaitre has also a large electric vibrator for the determination of the presence and position of magnetic foreign bodies. These radiologic units on hand in connection with the operating groups are merely for localization, the central radiologic and radiographic plant under M. Nogier, an eminent physicist of the faculty of medicine of Lyon, is one of the best-equipped centers we have ever seen and is in another part of the compound. Clean gowns are provided for all visitors to the operating rooms. Ethyl chloride and ether are the anesthetics of preference—neither chloroform nor spinal anesthesia is employed. The anesthetist keeps notes on the operations.

A feature of this hospital is that every wound is voluminously dressed—to our mind unnecessarily so.

The evacuation department has been amply described elsewhere. In addition to the storeroom for regular hospital equipment a special storeroom for Red Cross supplies of American origin is kept, and as a matter of fact it is believed that this is a prominent source of the comforts enjoyed in this hospital. There is also a community store and a sort of post exchange for the men. There are bathrooms for men and officers and in the center of the compound, on one side of a square, buildings for female nurses, and buildings for male nurses on the other. The enlisted personnel of the hospital are quartered in barracks. The pharmacy is large and well equipped.

The kitchen.—This consists of a long building with stoves arranged in a row, each one presided over by a cook and one or two assistants. Food is dispensed by a sergeant at a desk before an open window. The ward orderlies line up before this window and give the sergeant the necessary information. He in his turn notes the information on a slip which each orderly presents, with his respective ward number and number of patients. The sergeant then calls off from each card the order for the food and the cooks handed it out as the orderlies passed by. Several thousand men are fed without friction or overcrowding and with surprising rapidity.

The laundries.—There are 12 to 18 in a group across the track from the hospital. They are of the portable variety.

The grounds.—In general these are laid out and have been well spaded for flowers and crops. There are several large red crosses in the grounds in conspicuous places, made of boards painted red and laid in the shape of a cross on whitewashed rocks. The water is piped to all parts of the grounds from a spring about 500 meters south and is said to be of good quality. The result is that there is running water in all buildings. The hospital is lighted by electricity from the town and from a local generator. They are changing the red cross at this hospital for a black one, which is noticed better by airplanes. No provision is made for the revetment of huts in this hospital, except some few which had sandbag protection from splinters. There is a cinema show given twice weekly. Usually the pictures are of scenes laid far from the war and war subjects. At these shows the orchestra furnishes music. This orchestra is recruited from among the patients and at times artists in comedy, drama, and song are brought here from Paris to vary these programs.

The quarters which were prepared for our students merit the kindest record. They have literally made over an entire barrack for 25 officers. They have waterproofed it with tar paper, painted it inside and whitewashed it out, and have partitioned it off into separate rooms. Each room contains one or two beds and is fitted out with linen and covers, stool table, washstand, wash basin, pitcher, and slop pail. The building is heated with three French stoves—not too hot.

Army Sanitary School No. 100.

MEMORANDUM No. 136

HEADQUARTERS 42d DIVISION,
OFFICE OF THE SURGEON, A. E. F.*To Surgeons of All Organizations:*

I. The following list of emergency surgical dressings, appliances, and gas-defense supplies has been prepared for the purpose of establishing in this division a uniform minimum equipment for regimental and battalion aid stations, advance aid posts, dressing stations, and ambulances, while the respective commands to which they are attached are serving in the line of the advance.

Surgeons of organizations will be held responsible for having on hand at all times at least the amount of such supplies as given below, and frequent checking shall be made and shortages requisitioned for at once.

Surgical dressings and appliances	Distribution							
	Regi- mental aid sta- tion Infan- try and Arti- lery	Infan- try battal- ion	Infan- try battal- ion aid station	Ad- vance aid posts	Arti- lery battal- ion aid station	Bat- tle po- sition	Ambu- lance dress- ing station	Ambu- lance
Adhesive Z. O.:								
1-foot rolls	0	2	2	0	2	0	4	-----
2½-inch rolls	2	12	6	2	4	2	12	-----
Ambrine, packages	2	2	2	0	2	0	4	-----
A. T. S. ampules	15	50	50	0	50	0	100	-----
A. T. S. combined syringe and serum	10	25	25	0	25	0	100	-----
Bandages:								
Muslin, 4-inch	6	60	24	12	24	12	150	-----
Muslin, 6-inch	6	40	16	8	24	8	50	-----
Triangle	12	144	48	24	48	24	150	-----
Bars, suspension	1	4	4	0	4	0	15	2
Basins, 1-quart (Ambrine)	1	1	1	0	1	1	1	-----
Blankets	20	30	30	10	30	10	24	12
Bottles, hot-water	3	6	6	0	6	0	12	3
Boxes, ambrine dressing	1	6	3	1	6	1	0	-----
Brush, camel's-hair, large	1	1	1	0	1	0	1	-----
Dressings, shell:								
Large	5	20	14	2	20	2	40	6
Small	10	40	31	3	40	4	80	6
United States	10	40	31	3	40	4	80	-----
Glue, Sinclair, pints	1	1	1	0	1	0	1	-----
Lanterns, common	3	6	3	1	3	1	6	-----
Lights:								
Carbide	1	2	2	0	1	0	0	-----
Flash	1	1	1	0	1	0	0	-----
Litters	3	20	5	5	2	3	20	4
Needles, Luer	4	4	4	0	4	0	6	-----
Pencils, indelible	1	2	2	0	1	0	2	-----
Splints:								
Arm hinge	1	6	3	1	1	2	15	1
Cabot	2	20	8	4	2	2	10	-----
Gauze, wire, roll	5	24	9	5	5	5	20	-----
Leg T, full ring	1	8	5	1	1	2	15	1
Leg T, half ring	1	8	5	1	1	2	15	1
Liston	0	2	2	0	2	0	1	-----
Wire, ladder	6	50	20	10	20	10	20	-----
Wood, 3-foot	4	12	6	2	2	4	10	-----
Wood, 4-foot	4	12	6	2	2	4	10	-----
Stirrup, Sinclair	1	8	8	0	8	0	4	2
Stove, sbock	1	2	2	0	2	0	2	-----
Straps and buckles	6	40	22	6	12	6	10	-----
Syringe:								
Luer	2	2	2	0	2	0	2	-----
Hypodermic	1	2	2	0	2	0	2	-----
Table, sbock	50	1	1	0	50	50	1	-----
Tablets, morphine, ¼ grain	60	60	60	0	60	0	400	-----
Wadding, cotton rolls	2	21	15	2	5	4	10	-----

See footnotes at end of table.

GAS-DEFENSE EQUIPMENT

Surgical dressings and appliances	Distribution							
	Regi- mental aid sta- tion Infan- try and Artil- lery	Infan- try battal- ion	Infan- try battal- ion aid station	Ad- van- ce aid posts	Artil- lery battal- ion aid station	Bat- tle po- sition	Ambu- lance dress- ing station	Ambu- lance
Ammonia, ampules, boxes.....	25	0	25	25	25	10	50	-----
Bottles:								
4-ounce.....	2	0	2	2	0	0	2	-----
For eye solution.....	6	0	6	6	3	2	6	-----
Boxes, fuel.....	2	0	2	2	0	0	2	-----
Caps, gas.....	4	0	4	2	2	2	6	-----
Catheters, rubber.....	3	0	3	3	0	0	6	-----
Coats, gas.....	4	0	4	2	2	2	6	-----
Droppers, medicine.....	3	0	3	2	0	0	5	-----
Fans, antigas.....	2	0	2	2	0	0	2	-----
Hexamine, pounds.....	1	0	1	1	1	0	1	-----
Jars, spray solution.....	1	0	1	1	0	0	1	-----
Klaxons.....	1	0	1	1	0	0	1	-----
Lime, chloride, pounds.....	100	0	100	100	100	100	100	-----
Masks, M4 French.....	(7)	0	(7)	(7)	(7)	(7)	(7)	-----
Mittens, gas, pairs.....	4	0	4	2	2	2	6	-----
Overalls, gas, pairs.....	4	0	4	2	2	2	6	-----
Oxygen, tanks and connections.....	1	0	1	1	0	0	3	-----
Respirators, box.....	(7)	0	(7)	(7)	(7)	(7)	(7)	-----
Respirators, Tissot.....	2	0	2	1	1	1	2	-----
Sodii hyposulphite, pounds.....	10	0	10	10	10	0	20	-----
Sodii sulphite, pounds.....	2	0	2	2	2	0	4	-----
Sodii carbonate, pounds.....	10	0	10	10	10	0	20	-----
Sodii bicarbonate, pounds.....	1	0	1	1	1	0	2	-----
Sodii chloride, pounds.....	1	0	1	1	1	0	2	-----
Sprays, Vermorel.....	1	0	1	1	0	0	1	-----
Tubing:								
Rubber, feet.....	6	0	6	6	0	0	12	-----
Glass, feet.....	3	0	3	3	0	0	6	-----

NOTE.—This is special surgical equipment and not intended to replace battalion combat equipment, par. 866, Manual for the Medical Department, but will be in addition to it, except as noted in remarks.

¹ Distribution at discretion of medical officer.

² Par. 866, Manual for the Medical Department.

³ 1 snowshoe, 2 ordinary; par. 866, Manual for the Medical Department.

⁴ When needed.

⁵ Provided when needed.

⁶ Equip. Greeley units, tablets in chest, M. and S.

⁷ 5 per cent strength of personnel extra.

J. W. GRISSINGER,
Lieutenant Colonel, Medical Corps, United States Army,
Division Surgeon.

MEMORANDUM No. 142

HEADQUARTERS 42D DIVISION,
OFFICE OF THE SURGEON, A. E. F.,
June 10, 1918.

To Surgeons of All Organizations:

1. The following additions are made to Memorandum No. 136, Headquarters 42d Division, office of the surgeon, dated June 4, 1918, as gas defense equipment for an ambulance:

Ammonia ampules.....	boxes.....	10
Catheters, rubber.....	number.....	4
Coats, gas.....	do.....	2
Masks, French.....	do.....	4
Mittens, gas.....	do.....	2
Oxygen tanks and connections (small tanks for ambulances).....	do.....	4

2. The surgeons will make the necessary entries, in the appropriate column, on Memorandum No. 136 mentioned above.

3. A copy of this memorandum to be furnished all medical officers in your command.

J. W. GRISSINGER,
Lieutenant Colonel, Medical Corps, United States Army,
Division Surgeon.

NOTE.—These memoranda have been considered of such importance that they are included in the literature of the Army Sanitary School.

Army Sanitary School No. 101.

ADDRESS OF MAJOR GOLDTHWAITE, DIVISION OF ORTHOPEDIC SURGERY, A. E. F.

Gentlemen, the orthopedic branch of medicine has been made very much more conspicuous in the war game, of course, than it has been in civil life, and it has led to a good deal of study. In the United States Army we have tried to profit by the experiences of the French and the British and adopt the best which they have worked out, so we are starting practically where they are in the best part of their organizations to-day, not where they were at the beginning of the war. For that which they have worked out we do not deserve any credit at all—except for having common sense enough to profit by their experience. The things which we are doing represent the best French and British organization.

The work of the division of orthopedic surgery divides itself at once into two parts: (1) That which has to do with reconstruction work, and (2) the classification of soldiers into classes A, B, C, and D, based upon their physical fitness for the Army.

“Reconstruction” is a term which has been used a great deal in connection with orthopedic work. The term used here means the reconstruction of the men in the precombat period. In other words, one of the most important parts of this work is that which has to do with making the men fit so they will be able to stand the stress and strain of combat. The need of this in our country is probably much greater than among the French or the Italians, and is greater than the need among the British, although among the latter it is greater than in the others mentioned. The reason for this necessity so prominent in our country is that we have been a nonmilitary people and we have allowed our youth to grow up without sufficient attention being paid to the physical education or the physical training of the body.

The posture which we have allowed our young people to develop and which we ourselves are assuming is just as much a stamp of ignorance as it would be if that same individual were to use some ungrammatical expression. Some day our country is going to see that the thing that we are struggling with to-day has been overcome by our educational system at home. You know perfectly well that the common attitude of our college boy to-day is this sort of thing (slouching). It is this swagger which the college man of our country prides himself on. The stoop and the slouch are perfectly definite types to-day and the little kid gets it in the preparatory school and it's the same way on up. If his father tells him to stand up straight he says “the old man is a bug”; the girls, of course, have copied it on their part in the “Gaby slouch” and other poses. It is one of the most serious things which our Nation has before it to-day. Now the question of posture has come straight home. Those types of postures mean weak men; they mean weak women; and the coming generations are going to be of the same type if we don't succeed in ousting these unhealthful poses. The problem that confronts us is to make men of these weaklings.

Now, a lot of men are here in France to-day, not by tens and hundreds, but by thousands; and if you take them out on a 10-mile hike you bring them in ready for the scrap heap; and if you scrap all of these men it means a loss of a large proportion of your forces, which will make it pretty difficult to supply your replacements. It means that your transports back with the men that you have to eliminate will be pretty nearly as full as when they came over. When we first undertook this work Colonel Bevans made the remark that at least 15 per cent of the troops would come in with defects which we are trying to correct.

There are two types of weakness: The most common is flat foot. Now, get out of your heads at once that flat foot is a disease. Men with flat feet should not be admitted to sick report. Flat foot is a weakness, and the soldier ought to be just as much ashamed of that weakness as he would be of any other.

The other condition is weak back.

These two elements, weak feet and weak back, are, of course, the most common weaknesses of the body for anatomical reasons. You will find a great number of instances of weak backs, lumbago, muscle strains, and that sort of thing, and these are the conditions that account for the largest number of unfit in a training period. Now, the question comes up, What are you going to do with them?

Recognizing that that condition was a weakness, not a disease, the experiment was tried of taking those men off sick report at once and assigning them to special duty with the idea of overcoming that weakness. That it was a weakness rather than a disease at once became obvious after you had studied the men. The day this was started we had about 25 or 30 men who had been sent in to get a certificate of discharge on account of permanent disability. There they were. All standing this way [illustrating]. Here are some tracings of these men [showing]. These are tracings of the men they are sending over here—a part of the fighting force of the United States Army. Now, I don't think you would hesitate to go up against that sort of a man? These types here are certainly not types that you would pick out as those of a very vigorous manhood. A man standing that way will inevitably have symptoms in the two parts of the body that are weak. He will have flat feet, of course; and he will have a weak back. That type of man will have a weak back in a short time after he is used hard physically. He will also have flat feet, because the moment you let yourself down thus [illustrating] the weight is thrown entirely upon the heels. Now, no ligament has ever been created that will stand strain long without stretching. Try it yourselves and see the way it lets the weight off your body at once. I am on my heels. No man living can stand that way for long without the feet getting tired. Now, pull yourselves up in the position of a soldier. You at once pull yourself over on the ball of the foot. You have the spring and the stretch under you, and no man standing that way will ever get flat feet. If you train a man to use his body rightly you can cure almost any case of flat foot. We have recommended that no man with flat feet be discharged from the Army. Some one said that undoubtedly in the next draft flat feet would not be considered an excuse for being exempted from service; such men would be put into a special training battalion, an experiment which has been proved feasible. You can see what it is to reduce flat foot and weak back to these terms. Such men should not be allowed on sick report and should be made to realize that they have a weakness and not a disease; that medicine is not used in that case and that it is up to him to get strong. Since it is a matter of reeducation, what we have to do with our men is to teach them how to use their feet, just as in the primary schools you show the child how to shape the letters. One is not more difficult than the other; it is a question entirely of muscle training. As a matter of fact, when you take these men and show them how to stand and how to walk and make them do it day after day, after a while it becomes absolutely automatic. It is not at all unreasonable to expect that man to use his body correctly after that. It becomes automatic with the individual. There is no question about that at all.

Now, individuals vary and the types of posture you see that lead to these things of course also vary very much. You can tell at once the type by looking at the man. What I want you to understand is that you don't have to ask a man if he has a lame back or wonder if he is going to have weak feet when he goes on a 10-mile hike. You can tell before he starts. I saw a training battalion at ———, with which Major Jones here had so much to do. We took Colonel Craig there one day; there were 1,500 men lined up in that battalion at the time. We said as we walked past them "There is a type. This man is no good. That man is nearly finished." You don't have to be a medical man to do it. Colonel Craig could have picked out the men just as we did. You can even tell if that man is trying to get out to the front, instead of trying to stay away; you can see some men won't be any good when they get there. Our work does not consist in just relieving a man of weak feet for a day. That does no real good. It means getting these men's feet so that when they go back with your stamp of fitness on them they will stay put and be men fit for combat. In those divisions that are

arriving in France to-day the situation is no better than in this battalion. In some cases the conditions are worse. Understand me clearly and remember that if a man stands this way [illustrating] he will have symptoms of these defects. The symptoms differ. You can tell them in a minute. Just walk down the line and pick them out.

In the 26th Division a scheme was worked out, largely by the medical department of that division, backed up by proper authority, whereby these men were collected and put in a special military unit. They were not on sick report; they were assigned for duty in that special battalion. It was a military unit, in command of a line officer. A schedule of activity was planned which had to do chiefly with what "the school of the soldier" stands for. In the first place you should take the men and talk to them. You should tell them there is only one way to use the feet and that is the way military posture is prescribed. Now, you can't get your chest filled out without pulling your chin in. Try pulling your chin in and see what happens. You can't pull your chin in without throwing out your chest, and you can't fill your chest with your chin forward. Try it yourself. In yawning, of course, we do it reflexly. You can not yawn with your head forward. Nothing happens until you pull your chin in. You can not sigh unless you pull your chin in. We say to a man: "Pull your chin in. Pull your chest up and get a good big place for breathing." Next, we get them to stand right, on the balls of the feet. Then they get bayonet drill, marching, parading, bomb throwing, all the things the men should get in their training for combat. In marching, for instance, the step is speeded up to 140 to 160 a minute, quick, snappy movements; not sloppy, half-hearted ones. Drill every bit of the schedule, whether 10 minutes or half an hour, this to depend on what you mean to do. Keep them busy all the time, but rest the muscles every little while. Make the men remember that their trouble is a weakness and that they ought to be ashamed of it. Tell them, "If you have trouble with your feet, stand up straighter and you won't have weak feet."

In walking, we show the men the proper way, and if they walk that way they won't have weak feet. We don't give them a lecture on weak back; that would be a positive suggestion. We say: "Use your body this way and you needn't worry about your feet and about your back."

All this means that you reclaim the men with these conditions in a comparatively short time and you can send them back to their commands, not as convalescents from hospitals but as good soldiers. The schedule for the first week is prescribed. At the end of the week the orthopedic surgeon in charge examines the men. If they are sufficiently improved they are promoted to another company, the second class, which has more work. They have a schedule of military work under line officers, and the men for the second week are drilled on a more severe schedule. Everything is speeded up. At the end of that week these same men are examined again. If a man has improved enough he is promoted to the next company. At the end of another week he is examined again and if he is coming along all right he is moved up to the top company, and that means he is pretty nearly ready to go back to his command. The top company has a schedule which is almost up to a combat training schedule. He is expected to march 10 miles every morning or afternoon with a full pack and to train pretty much as a combat man would. If he can stand that you can easily see that he is all right. All you have to do is to walk up and down the line. The man should have the springy step, using the front of the foot to get the spring of the arch, not striking the heels as he goes along. When you get these men in shape they can march better than they ever marched before. You don't need to worry about their breaking down again. They will stay put.

Now this is the part of the work of the division of orthopedic surgery, keeping the men fit in this sense, relieving the medical officers of an enormous amount of bother which such soldiers cause in the command, and making them fit for campaign.

At present in the Army, as you know, men are graded into classes A, B, C, and D. It is recognized that some men can not be brought to fitness for combat, generally, because of underlying pathological conditions which were overlooked when they got into the Army. Why we overlooked them, I don't know. There are a number of things that make it impossible to bring a man to the point of fitness for combat. We saw one case among the marines. Every time this man fired his rifle he was laid up with a lame shoulder. When we examined

the man he had absolutely no muscle padding in his shoulder. He had had infantile paralysis when very young. When he fired he hit the great tuberosity of the humerus. You can not make that man over so that he can fire a rifle; you have to assign him to some other job, don't you see? In your special training battalions you have time to assign a man like this. Such a man would be a perfect machine gunner, for instance, or he could do many other things—clerical work, work in a labor battalion, or take one of a great many other jobs in the Army which are open. So you have in such a center a place for studying and classifying men who are not going to be of full combat fitness, and you have them long enough to determine the stuff that is in them.

That is a part of the work of the orthopedic surgeon, and you will realize it the deeper you get into this game. Those of you who haven't already been serving as battalion surgeons realize that there is a great deal of this work. Of course, it isn't done at the front; it should be done farther back, as it is going to be done; but you have in the advanced zone to-day a number of men who are a nuisance to their organizations. There we should have men who can be depended upon to go over the top.

These organizations of reconstruction are called special training battalions. The place in which they are cantoned isn't even called a convalescent camp. There is no special sick call. It is a military unit like all others. They have Army discipline. In fact the whole atmosphere is that of a military camp.

Now this is the solution of the problem, as I see it. Flat foot is a thing that you needn't bother your head about; that will take care of itself. Remember, please, such things don't go in the Army any more. These special training battalions will get them fit and do it quickly and efficiently. And remember once you get a man fit he will never lose that military bearing and appearance. To show that this is not a too hopeful view, let me tell you a story: A number of years ago a British retired lieutenant general came to see me in my office. We had at that time a kind of doorman we had picked up in one of the clinics. He was down and out. We had him under our care for a couple of years and then gave him a job in the office as an extra man around the place. This man opened the door for the general as he came in and indicated to the general the room in which he would find me. The general came in my office and said: "Where did you get that fellow? He has been in our Army." I said: "I don't believe he has, General; he has been in this country for 13 or 14 years." But the general repeated: "He has been in our Army." When he went out John opened the door for him, and the general said: "What regiment were you in?" John came to attention and told him. I asked the general how he knew. He looked at me with an expression of infinite pity. "Why," he said, "Doctor, once a man has been in our Army he never forgets it." Now, there was a man who had been in our country for 13 or 14 years; had knocked around hospitals for a couple of years; was all in, down and out, but yet he carried something with him that made that general interested to know what regiment he had been in. He recognized something that couldn't be taken out of him. It is not unreasonable when you stop to think what it means.

As to the organization of the division of orthopedic surgery:

The chief surgeon has a director of the division of orthopedic surgery. Then there are assistant directors who are given responsibility for certain parts of the work. In the divisions and in each of the brigades are men who are held responsible by the division surgeon for the proper splinting of fractures, for instance, as well as for the proper shoeing of the men. If a man gets trench foot this designated officer is held responsible and expected to report to the division surgeon. In the combat divisions these special medical officers are placed well forward and are given the responsibility of seeing that the splints, which are made to standard, are placed in regimental aid stations, etc.; not only that the splints are there, but that the stretcher bearers and ambulance men know how to use them and do it well in every case. Thus the division surgeon has some one whom he can hold responsible for that specific thing. We have juniors in each brigade under them, all the way along. In the replacement divisions we have our own officers whipping men into shape. All this force is supervised by assistant directors whose duty it is to go forward into the dug-outs and see that everyone is doing his special work. If organizations are having too much trench foot, or something else bearing on our work, the division surgeon is informed of it.

In this way things can be checked up before they get by. These men also have the responsibility for proper transportation of orthopedic cases, not only from the front line to hospitals but also on hospital trains.

Of course, there are surgical problems involved in this, and Major Finney has probably told you about them. The work, of course, is largely joint surgery; and since there are a great many mechanical problems connected with this, Major Finney worked out a scheme by which we place orthopedic surgeons in the evacuation hospitals who know the work. On the hospital trains, at the request of Colonel Stark, we have put an orthopedic surgeon because he says he wants some one there who will be responsible for the joints and bones in transit. In the zone of the interior the work is divided up between the general surgeons and orthopedic surgeons. These things are of more importance probably than a good many of you imagine. A man may lose his leg not because of a bullet wound or smashed femur—the injury may not be the main thing that makes him lose his leg; the transportation of the man may be what causes it. For that reason the splinting is being done just as far forward as we can get the splints—even to No Man's Land. You want to get them on as soon as you can so that the work later to be done on that man will not be obstructed by any damage to the part en route.

Army Sanitary School No. 102.

VISIT TO THE TRENCHES, LEFT SECTOR, OF STUDENT OFFICERS, ARMY SANITARY SCHOOL,
SECOND SESSION

GROUP UNDER COLONEL ASHFORD

The left sector was the scene of a violent engagement which was one of the most historic of this war. We reached the headquarters of the division surgeon, M. Thoris, in the early morning and set out for our visit to the trenches. We reached a canal by motor and left it to walk along the opposite bank to a small relay station of the G. B. D. in the reverse side of the bank, right near the bridge crossing the river. It was a point of embarkation of patients on motor barges holding 20 patients, for a second relay farther down, the point of debarkation from which these patients were forwarded over a motor road by ambulances to the main G. B. D. This was necessary, not only on account of the distance, but because the canal here was extremely dangerous, the banks being lined with artillery. In fact, as the barges were shelled by the enemy, transfer was usually made at night. The dugout here had one room, well heated and well protected from splinters. At this point we crossed the river. This was a famous crossing. Cæsar remarks in his commentaries on the great difficulties of this terrain, but here defeated the Germans after a hard-fought battle. The bridge was a military one, well camouflaged but in full view of the Germans, who gave it their most careful attention as we saw and later experienced. It was very frequently wrecked. After leaving a planked road built to cross the marshes, we came to the opening of the communicating trench, but the morning was a little misty, and the division surgeon stated that he believed it a propitious day to visit the abandoned tanks used in a recent battle. To do this we struck out in the open at a brisk walk with 50 yards distance between each two men. It is the only way to appreciate the difficulties of terrain plowed up by shells, and the completeness of artillery preparation will never be understood until one has had this experience. There was not a vestige of vegetation, and the shell holes touched they were so thick. We made a good inspection of these tanks, and then walked across country to the communicating trench leading to a battalion support aid station, reaching it just as the mist cleared away. The trenches here had no duck boards, but were wide, well built, and entirely suited for a narrow wheel litter.

The battalion aid post was in an old German dugout, with a narrow steep entrance requiring one to descend backwards. It was not commodious, but there were several galleries. It had electric lights, telephone, and stoves. The ventilation was poor and, while fairly well supplied, it was not a very good station. It was, however, clean and well white-washed, and its weak points were in construction, not neatness. Folding litter racks lined the galleries for recumbent cases.

The next battalion aid station was in a complete trench system captured from the Germans and was not only interesting but very well organized. The men were lined up for dinner and we had to squeeze past them to get on. The whole battalion here suddenly disappeared underground into a series of electric-lighted tunnels. The battalion commander showed us the Dutch furniture of the officer's messes, with signs in every direction that this or that was "verboden." It was especially "verboden" to enter certain galleries where officers were quartered. They had managed to drag up here a lot of furniture, and yet the whole system was much less roomy than the French or British, and damp and musty in addition. In this system was found the battalion aid station.

We now visited the regimental aid station, a plan of which is seen in M. Collin's treatise on "Organization and operation of aid stations in army corps and litter bearer groups." It was the very best regimental aid station ever shown a class of the Army Sanitary School. The descent was gradual, by good steps, but there was no vestibule for resting the litter while the first gas curtain was being closed behind. The gas curtains were also of doubtful efficacy, as they were two overlapping weighted curtains which were supposed to fall into place as one passed through; as a matter of fact they took four minutes to adjust them in a demonstration. The main gallery was wide and provided with litter rests against the wall. The room of the medical officer was almost luxurious, with its full-sized bed, mattress, sheets and pillow, easy chair, walls papered with a pretty design, etc.

Across the gallery was the kitchenette and dining room, which was just as comfortable. We were served hot coffee here in fancy cups, with saucers and silver-plated spoons, on a table with a clean tablecloth. In fact they made a great specialty of not only hot drinks but of hot food for hungry wounded.

A step or two farther was an office, and farther on an operating room which was well supplied with instruments, dressing, etc., and could easily handle major cases. There was a ward for 20 stretcher cases. Near the kitchen was a well, 30 feet deep, and the water is chlorinated before drinking. The men were clean, well shaven, and spry. This station was really capable of handling serious surgical emergencies—abdominal hemorrhages, chest cases, etc. The sterilizing outfit was good—there were even operating gowns. This dugout was a full 6 m. underground and was absolutely clean and neat. Every wall was whitewashed and everything in its place. This station would easily hold 100 cases sitting and lying, and had a good shock room for heating patients and performing blood transfusion. We saw one Thomas splint here. They had acetylene lights in case the electricity failed them, and the ventilation was excellent. No Medical Department enlisted personnel was quartered here, nor were they allowed to use it as a lounging place. These men had their dugout "next door." We were told here that the elaborateness of this station was all the more necessary as it took three hours to get a man this far after he was wounded and, as after leaving here there was a long distance to traverse before the G. B. D. was reached it was necessary to have some independent surgical resources. In fact this is a very bad sector indeed. The terrain is flat and in full view of the Germans, and as they held this position a long time themselves they know it. Besides withdrawal of wounded is limited to a single route, and a river has to be crossed as well as a canal traversed and the sector is very deep. Barrages fall with great regularity here and there, and men are thus held up on their way back. For these reasons relay stations of the G. B. D. are found every 1,000 yards on the route to the rear.

On our way back, we visited one of these, a very complete one where, as at the regimental aid station, not only hot drinks but hot foods were provided. Here we were given a demonstration of the Peugeot wheel litter modified by Colonel Thoris so that the wheels were under the litter in such wise as not to project beyond the sides of the litter. It was possible to use this vehicle all the way back to the bridge by the communicating trench which had been set apart for the medical department and so labeled. It was in excellent condition, and was kept up by the litter bearers of the division and appropriately labeled. Here also the personnel of the relay station turned out with Tissot masks and with full mustard gas clothing and mittens, the trousers having no fly and tape being provided for trousers' legs at ankles, waist, neck, and wrists, rubber boots were worn. Each man carried a bundle of sticks painted yellow to mark points contaminated by mustard gas shells and a Vermorel sprayer to treat same.

We had considerable difficulty in returning owing to shell and machine-gun fire, particularly machine gun at a second bridge over the river. On reaching the canal a hostile plane over us drew a lively fire, which ended in the opening up of batteries along the canal. We split up into two's and crossed the open ground to a ruined town where the ambulance head was in a dugout in the side of a hill.

Here we took the motor ambulance and proceeded to a group of three field ambulances, where we had a cordial reception from the officers who had prepared us a luncheon. To our great surprise, M. Chas. Richet, member of the academy, was staying here with them. This very active old gentleman has never been able to keep away from the front since the war began. He returns to Paris every now and then, but he is usually to be found with the men. His frank admiration of our country and soldiers, it was easy to see, was very genuine.

This hospital was a rival of the one seen yesterday and is certainly a close second in neatness, efficiency, and completeness. It was M. Okinezye's operating unit. It was well in range, and a shell not long ago burst in one of the buildings and killed five surgeons, although the place is isolated from all dumps and was plainly marked with a Red Cross. The grounds were beautifully kept and were the park of an old château, which was the administration building. In this building were also rooms for sick and wounded officers. The hospital accommodations were furnished by Bessonneau tents and Adrian barracks, which were revetted against avion attacks.

The same general arrangements were made here as at the twin group seen yesterday. There was an operating group, with its *groupe complémentaire de chirurgie* (portable radiologic equipment), a hospitalization section, a triage, and an evacuation section. The shock room apparatus here was elaborate, the hood had a window out of which a man's arms could be thrust while he was being heated, facilitating pulse taking, transfusion, etc. The hoods were of canvas heated by electric light bulbs. The head was always left outside. We were told that the temperature can be raised this way to 55° C. and that if a kerosene lamp with a stove pipe is substituted it can be raised to 35° C., an alcohol lamp will raise it to 30° C. The radiographic and operating rooms were clean and comfortable, besides being exceedingly well equipped. The latter rooms were fairly glistening with white enamel paint. The hospital was lighted by the portable radiologic group.

The commanding officer of this ambulance isolated all of his streptococcus cases in one ward, a Bessonneau tent well removed from the others. We saw a good pathological and bacteriological laboratory here, and it was evident that keen liaison with the surgeons was being carried out. All wounds are carefully cultured. In quiet times they keep all patients they can and, in fact, it was an evacuation hospital of the first echelon. It was at the time pretty well filled with serious cases. Some of these were remarkable, especially the chest and abdominal ones. There was an X-ray operating table in this operating group, with a fluoroscopic bonnet for multiple lodged fragments. The sterilization plant was perfect. The personnel, except the officers, was billeted in the near-by village. The triage was as usual, reception room (in a Bessonneau tent), preoperating room, shock room, then the two operating rooms, with sterilizing room and X-ray room (referred to as the operating group), all connected by heated covered passages. Everything about this place was neat, tidy, and clean. The floors were sanded. The triage had thorough arrangements for giving incoming patients for evacuation a square meal or at least hot drinks. The kitchen was in a wing of the château, and the food was excellent in quantity and quality. In this hospital, as at the one seen yesterday, great pains had been taken to make it ornate and pleasing to the eye. Here a remarkable frieze was seen and murals painted by a noted artist who was for some time a patient. The especially notable feature in both of these hospitals was the excellent spirit of the medical officers toward their patients. They worked hard, had no complaints, made the most of what they had, and got splendid results. The men had perfect confidence in them and seemed proud of their wounds. Fine spirit of cooperation and confidence in scientific work.

After leaving here we visited another ambulance group in a cantonment area for gassed and slightly wounded. The gas station was being completed. It was on the general plan already described. The triage here was very elaborate. It was for the slightly wounded and they were passed after this triage directly into a large Bessonneau hangar prepared mainly for "sitters." In connection with this was a complete operating group—operating

rooms, sterilizing room, radiologic room, as well as shock and preoperating rooms. In this town, which was a divisional rest cantonment, was a divisional bath station, the section d'hygiene corporelle, described elsewhere. The dirty underclothing is sent to a near-by town for laundering. This tent bath station was near a small stream on the outskirts of town and is the first place visited by troops returning from the trenches to rest. The floor was of cement. The outer clothing when it comes out of the sterilizer is warm, but not wet. They say they can take care of 2,000 men in 24 hours. The French soldier needs no bulky barrack bag with its extra suits of underwear, stockings, and shoes. He comes to look at the bathing station as his surplus kit. Moreover, torn and damaged clothing can often be repaired here. There is a barber shop connected with this bathing station. The whole station can be set up or taken down in 12 hours by 8 men.

GROUP UNDER COLONEL PORTER

The ground was covered by Colonel Ashford; report preceding, as this group made the same trip, but on another day, January 29. Only additional notes will be made:

G. B. D. relay for embarkation on canal.—The room for receiving patients was furnished with 16 bunks, heating apparatus for shock, and was prepared to dress wounds. It was lighted by acetylene lamps. It also had another passage capable of holding 30 more patients. Near by was a set of dugouts for the divisional stretcher bearers (144). They were within 1½ miles of the front line at this point.

Medical department trench for evacuation of wounded from advanced relay of G. B. D.—It was a model of condition and convenience and was wide and drained on the side. The wheeled litter used here could get men to the rear in this trench on the run, as it was well sprung; the wheels, being underneath, could not knock against anything, and it was light. The signs pointing the way were well painted and in relief so that they could be felt with the hand on a dark night.

Regimental aid station.—There was a separate mess room and sleeping quarters for non-commissioned officers.

Second battalion aid post, described as being in a tunnel very thoroughly equipped with roomy beds, litter rests, warming apparatus, and could accommodate 100 patients. It was lighted by electricity. There was a small operating room apart from the dressing room. This aid station was connected by a gallery with the kitchen and dugouts for quartering and feeding the Medical Department enlisted personnel, who were never allowed to take up their quarters in the station itself, M. Thoris's rule in this sector (and a mighty good one, too). A straddle trench latrine screened by burlap was seen here.

The last G. B. D. advanced post was a sandbagged shelter in the side of a hill—not really a station. It was near an artillery position and was directly exposed to shell fire. We walked from here one-half to three-fourths mile farther back to the nearest point to which ambulances were permitted to come in the day.

Field ambulance group of M. Okinczyk (capacity 800 beds).—Many donors kept here for blood transfusion. All division motor ambulances held here in the courtyard. We saw an American ambulance section here.

Ambulance group for gassed and slightly wounded (capacity 600 beds).—Siek also kept here. Buildings were of frame except administration building, which was a house, as it was in a town.

Remark of one of the student officers.—"It was very evident that the working out of the method of evacuation as laid down for the French Army is departed from in practice. There was a great deal of individualism in the manner of conducting these posts. Good officers had good posts and bad officers had bad posts. The matter of more direct evacuation was more or less freely discussed with French surgeons, and it was fairly generally conceded that more direct evacuation to a definite place of treatment would be an improvement." This division surgeon stated that he secured everything he wanted because he never promised anything to anyone without making good.

Army Sanitary School No. 103.

TRIP TO TRENCHES, LEFT SECTOR

UNDER MAJOR M'DONALD, MAY 11, 1918

Members of group: Major Neer, Captains Smith, Chase, McCalman, and Aldrich.

Left at 4.30 a. m. and met the division surgeon and the regimental surgeon of the Nth Regiment of Infantry at a small deserted village 5 km. in the rear of the first line. After a short explanation of the disposal of the Medical Department services in this sector and a demonstration of the map presented by the division surgeon, the party started for the trenches, having as their objective a battalion aid station of the second line. The weather was cloudy and misty and visibility low; therefore we were able to approach within 500 yards of this battalion aid station before entering the communicating trench.

After passing through about 500 yards of well-constructed communicating trench, we came to the battalion aid station in question. This was in a dugout with 10 to 12 meters of overhead cover. There were two entrances, with a 30° slope straight down. Over each entrance was, crossed, a French flag and a Red Cross flag, a gas-alarm bell, and a Klaxon horn. Each entrance was protected from gas by two curtains placed far enough apart for a recumbent patient between, and, in addition, behind each curtain was a swinging door of wooden frame and canvas filling.

In the receiving room there were folding bracket litter supports attached to the wall on either side, there being three such, one above the other. There were also benches for sitting wounded. On the right of this entrance was the dressing room, in which was a table, a large supply of surgical dressings and antiseptics, and an oxygen-administering apparatus. There was also a 3 per cent solution of bicarbonate of soda for the eyes and mouth in vesicant gas cases. Ipecac was also noted among the drugs for the treatment of such cases. The oxygen was stored in 300-liter tanks. There was a Vermorel spray for the spraying of walls and cleaning the floors of the dugout in case of gassing. This, however, was very little used, as the regimental surgeon stated that he preferred fires and gas fans. There were also 300 masks here as a battalion reserve. Draeger apparatus was used for CO, and a Tissot mask was also seen. In the large entrance hall there was a supply of rubber boots and gas-proof clothing, with mittens, for the men who handled Yperited cases, as well as a supply of ordinary clothing for patients; 20 to 25 cases could be accommodated in this dugout. The operating room was 15 by 18 feet, and porch-curtaining material was used for splinting of small bones. There were 4 men seen on duty, 1 medical officer and 1 auxiliary medical officer who had been a medical student only two years. Four litters were seen here, and one was set up on a trestle in the dressing room. This station was especially neat and orderly; the walls were well whitewashed, and the floors, walls, and ceiling were wood. About 50 yards from the entrance of this station there was a small bomb-proof shelter used as a bathroom for vesicant gas cases, it being necessary to free these men from vesicant gas before they were taken into the aid station. The personnel of the station slept in near-by dugouts and not in the station itself.

Leaving here, we followed the route of evacuation of wounded to the rear through the communicating trench. At night wounded were received by motor ambulances directly, but during the day it was necessary to carry them on litters a distance of 2 km. to the nearest post principal of the G. B. D. This entire distance was covered in the trenches on clear days, but on days of low visibility by wheeled litters on certain paths. About halfway from the aid station to the G. B. D. post was found a small post of the G. B. D. acting as a stretcher relay station. This was quartered in the ruins of an old mill once used by the boche. Litter bearers from the aid station carry to this relay and return, and the patient is forwarded by the relay to the G. B. D., which is about a thousand yards away. The principal G. B. D. station corresponded to our ambulance dressing station. To it the wounded were brought on the standard litter or hammock, through the communicating trench; when conditions permitted, they were brought on wheeled litters from the relay post mentioned before. This post was established in a large cellar in the ruins of a small village; there was room for 18 recumbent wounded and three or four times that many sitting. The entire division had two of these ambulance posts, both of which were ambulance heads. This one had a cave for

men who were temporarily unable to proceed farther. A second cave led down from the first and was proof against all save heavy bombardment. The station had hot-water bottles, dressings, and medical supplies. There was a dressing room; also a small room fitted up with warming devices for combating shock. One or two motor ambulances were kept stationed in the immediate vicinity of this dressing station, but the wounded were not delayed at this station if in condition to be transported farther to the rear. Only emergency surgery and treatment for shock was provided for here. The village in which the G. B. D. is accommodated is in ruins.

From this point the wounded were evacuated by motor ambulance to a field ambulance 7 or 8 km. to the rear.

From this point we returned to near the point we had first left to visit the regimental aid station of the Nth Infantry Regiment. This was in an old château 4 km. in the rear of the first line. Owing to its location and distance from the front it was not being used for wounded, but served as a rest station for slightly sick who could be treated for two or three days at that place. There was a ward with eight improvised beds, a gas room containing solutions and medicines, clothing, etc., for gas cases, and a main ward room. It was located in the cellar; both entrances were gas-proofed with curtains, and a revetment wall was placed in front of the main entrance to protect it from shell fire. There were several small chambers in this cellar in addition to the large ward room. In a small room were noted supplies of dressings, clothing, etc. There were no patients here, as this sector is very quiet, although battalions were in battle formation expecting trouble. As a matter of fact the regimental aid station is acting here as a sort of field hospital.

COLONEL ASHFORD'S GROUP, MAY 12

Left at 4.30 a. m.; arrived at the town described by Major McDonald, where we were met by a lieutenant colonel, a division surgeon of an English division, who was there with his adjutant, a captain, to take over from the French. We had met before at the British front. He accompanied us in our inspection. This was in charge of the retiring French officer, who represented the division surgeon, Colonel Thoris, away on leave at the time. We walked directly to the battalion post of the second line visited by Major McDonald's party. This post was protected by a low ridge, but it was in plain view of an observation balloon. The day, however, was cloudy. The battalion aid station was stationed behind the main road from ——— to ———, and was at the junction of two communicating trenches. It was known as the battalion aid station of St. Georges, and was a model, as are all the stations with which M. Thoris is connected. The road was camouflaged and the post was very deep. The medical officer in command gave us a most excellent talk on battalion aid station work. The criticism of this dugout was that there was no horizontal landing between gas curtains for a litter, but a second gas curtain was interposed on the way downstairs. There were several Tissot masks for all attendants. The dressing room had a good supply of drugs, and sutures and ligatures for tying arteries. There were 300 made dressings on shelves, a supply of medicines, antitetanic serum, a box of general operating instruments, an amputating set, and a tracheotomy set. The battalion surgeon stated that he never did an amputation unless the limb was dangling; but if this place is cut off by a barrage they can perform necessary emergency operations. He stated that there is one dentist to each regiment, but that he is left in the rear in the rest station when the regiment is in the line.

The Thomas splint here was a modified Blake with a sliding foot piece, which is of no account. At this station the fêche or diagnosis tag only is made out. The tourniquets used were the Esmarch, but a large rubber tube was preferred. The latrines were outside of the dug-out in a communicating trench. A reserve tank of water was in a trench leading off from a traverse.

A modification of gas mask M² for giving oxygen consisted in piercing it and introducing a catheter, which was connected up with the source of oxygen. For chlorine cases they give hypodermically one two-hundred-and-fortieth of a grain of atropine, or ether or camphorated oil hypodermically, or emetine in one-sixth of a grain doses. If there is edema of the lungs they use wet cups. The treatment of the mustard-gas cases is thorough and includes

washing the eyes with bicarbonate and the body with alkaline soap. Such cases have their clothing changed in a separate dugout nearby. These cases can usually walk at first, but are transported as sitting cases if constitutional symptoms come on. In periods of calm, sick call is held here and the men are brought in in a body. A sick man could even be left here a day or two, as there is usually plenty of room. If they do not get better they are then sent back to the regimental hospital, with a capacity of 40 beds, where they may stay 15 days. During a push, if they need to be evacuated, they are sent to the rear to the divisional rest station. There were 12 full sets of mustard-gas clothing with boots for the men. Shell holes are disimpregnated of mustard gas with the Vermorel apparatus.

At the battalion aid station, St. Georges, antitetanic serum is given, always. We noticed two 300-liter and one 600-liter oxygen tanks. The personnel of this station is 3 medical officers, 1 chemist, 1 sergeant, and 28 men, of which 16 are kept in the line with the troops and 12 here. All of the heavy material at this station is considered as trench supplies that can not be moved. They have the exchange system in this sector; what is taken away is replaced by the organization replacing it. The Draeger apparatus is furnished at the rate of four per battalion. They last half an hour and are nothing more or less than small oxygen tanks, used especially in artillery saps where CO gas is so deadly.

At the town of ———, which was entirely in ruins, we saw the C. B. D., which was an advanced post in echelon and next to the last in the series, the last being the main one. There were 1 noncommissioned officer and 20 men on duty, and at this place were kept two ambulances. The cellars in which this post was accommodated were proof against 6-inch shells. It had folding gas doors and provisions were made for deshoeking patients and for emergency operations. Hot drinks were furnished, and there was a receiving ward for gassed cases. Dressings, litters, etc., were abundant, and we noticed a modified Peugeot wheeled litter. There was a separate room for sitting wounded. This post was being taken over by the British at the time and their ambulances were there.

From this place we proceeded to the main G. B. D. post, the last of the echelon. This would serve as a model for any ambulance dressing station. It was on a height, but in an excavation which hid it and prevented a sky-line view by the enemy. As a matter of fact it looked like a fort, and every entrance had its parados of sandbags. It was clean, well white-washed, and had 30° slopes to its entrances, which were straight. There was plenty of room for 60 or 70 patients and all matériel necessary for emergency treatment. The matériel included an elaborate plant for treating gassed cases, and an equally elaborate canteen for hot drinks and food for wounded. Two ambulances were always kept on duty here.

VISIT TO RIGHT SECTOR MAY 11, 1918

Breakfast at 4.45 a. m. Left Bouleuse at 5 a. m. Arrived at destination in about half an hour by motor. This was the headquarters of the division surgeon. The G. B. D. had three subposts; one for gassed cases, one for slightly wounded, and one surgical station, in connection therewith. At this place triage was accomplished. There was accommodation for 80 patients in the cellar of a bombproof house. There was a dressing station and shock room and a reception room.

We now visited the regimental poste de secours at Rome. This station opened directly into the regimental commander's headquarters and was commodious and ventilated through a broad gallery. To give an idea of its comfort, the medical officer's living room had upholstered furniture in it. There were accommodations for 25 lying and 40 sitting cases; the sitting cases being provided for on sheets folding against the wall; the lying, on litter racks which let down from the wall. Hot sandbags were provided; extra clothing for mustard-gas cases, and Thomas splints. It was lighted by miners' lamps.

We now visited the regimental post and special surgical advance post at ———. This was a dugout like the rest, in a pretty well shelled place, but at the time it was fairly quiet; they had occupied a cut in the side of the sunken road at the entrance of the dugout. This open gallery was merely splinter proof, but it offered an airy place for sick call, for slight dressings, and for booking the men. It was an effort to get away from the dugout life, even with a certain amount of risk. The feature of their dugout was a room for intransportable cases and an operating room connected therewith; here serious operations are undertaken on non-

transportable cases, the surgeon being telephoned for to the headquarters of the division surgeon; he ordinarily succeeds in getting here in about 20 minutes. It is perfectly evident, however, that serious operations should not be done here, and that it serves no very useful purpose, save for individuals at the expense of the mass. Here we heard that the saccharate of lime was made by adding 25 gm. of lime and 60 gm. of sugar to 1,000 c. c. of water; they used it extensively for mustard-gas cases with success, and did not use it only for the eyes, nose, and throat, but also bathed the patients with a 10 per cent solution of the mother liquor, as per above prescription.

We now visited a regimental aid post on a main road and under the very guns of a strongly fortified German position. The Medical Department is holding on to this place by its teeth and nails against heavy shelling, but it will have to be given up, as it is exposed to view and therefore invites fire. After all it is not a strong post and only the most urgent dressing can be done in it, but it was convenient and avoided a long detour.

From this place we walked through the trenches to the battalion aid post known as "la Marguerite," going out into the open over a path instead of by the devious communicating trench. By this route we had a good view of the strong position referred to. It was not over a thousand yards distant, over a perfectly flat country. The weather was slightly cloudy, or this direct path would have been impossible. There was very little in the battalion post to specially mention. The dressings were not gas proof, nor was there a clothing reserve for mustard cases. There were, however, 24 suits with boots for gangs working in impregnated spots. Three tanks of 150 m. of oxygen were kept here and a reserve of 136 masks. The overhead cover was excellent, there being 14 m. of earth. It was also large and could accommodate 18 lying and 50 sitting.

From here we proceeded to the canal, which was practically the front line of the French and the scene of many a coup-de-main, the earth thrown up on either side of the canal serving as a fortification. In fact they had had one the night before. They were drenched with gas and exposed to constant shell fire most of the time. The battalion aid station which served this sector was known as DeSage. Its capacity was 20 recumbent and 20 sitting. According to the medical officer in command, a very young man and still a medical student, there had never been any time to fix it up on account of the activity of the sector. His post was not whitewashed, there were no gas-proof boxes for dressings or food, and it seemed unusually damp. They had, however, pretty good protection from fire, with 6 m. of earth overhead. He evacuated his patients in hand cars at night over a narrow-gauge road to the G. B. D. advance post.

This was the last place we visited, and it was in a town that was literally shelled to bits. Here, also, was the battalion post of the second line, with a capacity for 32 recumbent and as many more sitting. It had an extra room for bathing gassed cases and changing their clothing. The medical officer in command had made a praiseworthy effort to utilize all the space for lying patients by placing the litters on racks, three tiers with only a half meter between each, but as the shelter was lined with elephant iron the space seemed too small, and once the litters were packed in with difficulty he had even greater difficulty in getting them out.

Army Sanitary School, No. 104.

VISIT TO TRENCHES, TO A FIELD AMBULANCE GROUP, AND TO A LARGE H. O. E., MAY 13, 1918

Left early on a misty morning to meet General Route, chief surgeon of the fourth army, who was to personally take us with his corps surgeon to a sector southeast of ——— in the ——— Valley. This was an interesting sector, inasmuch as it was through here that the medieval and early invasions of the Huns had taken place. Owing to the cloudy day, we were able to go over a road which could not usually be traveled, as it was high up on the edge of the hills defending the south of ———, in full view of the Germans, who lay 3 km. away just below, and we were able to fully make out their positions.

We met the general at ———, where he was waiting for us with his automobile. We changed to British ambulances, and proceeded by the ——— road to ———, where there was a regimental aid station which was at the same time an ambulance head, and from there

to an advance post of the G. B. D. The party had been divided into two groups of 10 each, as it was a fine day, and the ground was flat and observation was good. ——— was the R. A. P. for two battalions, one on the right and one on the left. We went to the right of the sector; the other party to the left. We rode in an ambulance to an advance G. B. D. station and there took the communicating trench, walking about 2 km. to the battalion aid station of the first line, passing several relay stations on the way. The trenches were in very good condition, although recently constructed, as this sector had not been long organized. The battalion aid station which we visited was almost beyond criticism. It was deep, with a good 10 m. protection, and well arranged, with whitewashed interior and two entrances; it had electric light, ample accommodations for 50 men, and was well equipped. It did not differ from the one we saw in Colonel Thoris's division. This battalion aid station was 2 m. wide and 25 m. long. It had a dressing room and separate quarters for sitting and lying. It was divided into four long compartments, each about 20 feet long, one being for gassed cases. Three wounded men were seen here at the time of our visit.

On our return we saw an advance G. B. D. post on the firing line side of a bridge over the canal. It had been established there owing to frequent shelling of the bridge and consequent interruption of evacuation for some hours. General Route said that he was suppressing his regimental aid posts to simplify evacuation. He said that advance surgical hospitals were generally not feasible, and it was better to get wounded back promptly to a hospital well in the rear. The main G. B. D. of this sector takes care of two divisions. They were expecting an attack and are in battle formation, one battalion behind the other.

We now proceeded to a very handsome group of three field ambulances for lunch. This group was really a small evacuation hospital of the first echelon. It was immobilized in barracks and tents. We were met in front of the building, where they had raised an American flag, by the corps commander, who had come down purposely to greet our American officers, and he spoke to us and gave us a very cordial welcome. The commanding officer of the hospital first took us to the triage, where he had his entire personnel of the hospital drawn up, officers and all. The grounds and buildings were in perfect condition and very ornate. A great deal of landscape gardening had been done to make it look attractive with flowers and walks. The site was a particularly good one for this, as it was surrounded by woods.

Particularly noticeable were the shock rooms, which were about the finest we have ever seen. There was no particular difference between this hospital and all the others, except that it was as perfect as one could wish and was considered a model of the first echelon evacuation hospital, although it still preserved its name of "ambulance."

From here we were taken to the large evacuation hospital of the second echelon, ———, 18 km. from the front, with a capacity of 3,000 patients. The feature of this hospital was that as one entered the main road which divided it, on the right-hand side were all of the offices, supply depots, etc., and on the left, beginning from front to rear, were the operating section and the evacuation, and at the rear the hospitalization section. There was a special quarter here for gassed cases, with the usual bathing facilities, etc. Their record is 600 in eight hours. They are separated into the vesicated and the asphyxiated cases, and the latter are housed in a Bessonneau hangar. At this station we were told that for outer clothing impregnated with mustard gas, 10 minutes at 90° in an autoclave is enough if they are aired three hours afterward. They can then be immediately put on without danger. General Route remarked that the Bessonneau tents, small as they were, did not stand the wind as well as the Bessonneau hangars; that he had 80 of them blow down in Salonica and his Bessonneau hangars stayed up. There was a bathing section here for the sick and wounded only. They had had only two cases of spirochetal jaundice in this hospital. They can do 120 major operations a day, which is the same as in the H. O. E. at Mont Notre Dame. There is one operating room set apart for septic cases.

Army Sanitary School No. 105.

WAR SURGERY

By Major Brewer, M. C., U. S. R., April 18, 1918

It is a great source of pleasure and gratification to me to come here to-day and meet you all again. As I said the other day, the first opportunity I had of seeing you, that I am here not as your superior officer, not as one who for any reason claims to be a past master in the art of military surgery, or to know any more about military surgery, or as much, as many of you; but I am here as one who is with you, a student of this problem, and what I want to say to you, is simply to convey to you certain impressions that I have gotten as I have gone along in my work.

It has been my privilege to be here in this country on two occasions. One in 1915, when during that summer I was in charge of a French base hospital near ——. Coming here a second time, about a year ago, I had the privilege of serving with the British at the base and front; and only during the past few months, since the 1st of January, have I had the opportunity of serving with our own people. But during that time I had opportunity to learn a good deal of the differences between the work of a civil practitioner and the work of a military surgeon.

Now, the first duty, as I take it, which should guide everybody who is to practice military surgery is this: His first duty is to seek to restore every wounded man to the line in the shortest possible time. Now, that in itself is entirely different from our conception of civil surgery. Take, for instance, a man who has had a severe injury. He comes to the civil surgeon; he is under him for a long period of time; he may have a painful operation and a painful period of convalescence. After going through that, the civil surgeon feels that his patient ought to have a change—to go to California for a while, or to take a trip to the south of France—that he is certainly entitled to a rest. All this is the last thing a military surgeon must think of. The minute that man is able and fit to be restored to the line, it is his duty to send him back—not before he is fit, but the minute he is fit. We must forget everything else. Why is that man here? He is here to win the war, not by being on a vacation or enjoying a leave of absence but by being on the job the first moment he is able. Therefore, we must neglect, throw aside the humanitarian side, and all idea of giving a man something in the way of repayment for what he has given. Our duty to our Government and to the allied cause is to restore him for front line work just as quickly as possible.

Now, the wounds in this war which are the chief causes of prolonged convalescence or of permanent disability, differ from the wounds of civil life and, indeed, from the wounds of any previous war, in their general character and extent, in their amazing multiplicity, in the shocking and paralyzing effects of high explosives, in the cruel and extensive lacerations of tissue, and in the deadly virulence of the infection which accompany them. The world has never seen such wounds. Surgeons have never before felt the inadequacy of the means which they had and employed in the past to combat septic infection. Now, that's a strong statement, but I believe it is absolutely true. I think anyone who has seen the surgery in the early part of this war, and has seen the able men giving their best effort to combat the type of sepsis which we see here, and saw them fail absolutely, will agree that it was due to the peculiar virulence of the infections which were found, which the world had never seen before. You have seen gas gangrene here, certainly. In civil life I have seen five cases that I personally treated and of these four were fatal. I succeeded in saving one. About once in four or five years I would see a case of gas gangrene. When I first came over here I asked about gangrene. "I can show you as much as you want to see. Pretty fatal; but we have in this hospital 27 at the moment," was the answer. I looked at these 27 cases and I was surprised that they were living. One man had a thigh injury in which the gas gangrene had spread so quickly that the tissues were involved halfway to his thorax. Well, they amputated at the hip joint and the man got well. I never saw a case in civil life that had gone a third that far that had gotten well. We simply cut off the leg and let it alone and the man got well. I think perhaps one of the reasons for this is that the men are in the most superb physical condition. You take a man who has lived all winter in the trenches, who has had plain food, hard exercise, and practically no alcohol; if he survives he is going to be in pretty good physical condition, and that was so with the men I came in contact with that

summer. They had a superb resistance, such as I never saw before. That is the reason they recover from these infections. Out of that 27 cases of gas gangrene only 5 died, and the methods employed were crude. They are not the methods used to-day, but the men had that wonderful resistance. So I say the chief cause of delayed convalescence, prolonged invalidism, or chronic or absolutely permanent disability is infection. Now, I can't give you any statistics, but I simply say that if you consider all the factors associated with battle casualties, including the primary injury, the bone shattering, the hemorrhage, the delayed treatment, and the bad transportation facilities, infection is the thing that does more harm and prevents more men getting well and results in more deaths and disability than everything else put together. It is to a large extent a question of infection. Therefore, how best to prevent and combat infection? To avoid it in the early cases you receive, and to treat it, once it is established, is the biggest problem of the military surgeon; and it is a problem upon which has been devoted more attention than any other factor; and, I am happy to say, with a larger measure of success. I called your attention just the other day to the great difference between the general appearance of the hospitals in 1915 and now. Just to repeat: In those days there was practically no clean surgery. I think that in all the time I was on duty during 1915, I never saw one single wound clean, if we except two or three cases operated on, after the battle casualties had healed entirely, for a secondary condition. I saw one case in which there was an internal appendix which healed kindly. Another case of secondary nerve suture and one in which there was some accidental wound which required but two or three sutures, which healed without infection.

With these exceptions I saw no clean cases until after the wound had passed to the stage of healing granulation. Not one single primary, delayed primary, or secondary closure; and the results were those that led me to believe that the greater proportion of our grave cases would be evacuated as chronic invalids. Now it is absolutely different. The large number of cases that you see in the hospitals to-day show none of the signs of infection exhibited by those two years ago. What has been the reason for this? There are two chief factors. These two factors are, in the first place, the definite, operative treatment of these cases has been transferred from the base hospital to the hospital in the advanced area; and the second reason is the use of new and more efficient antiseptic agents. Now, at the beginning, both the French and the British believed that the best plan was to place their best surgeons in the base hospitals. Have the advanced area men apply the first-aid dressings and send them back to the rear, out of the reach of shells, and to the quiet of base hospitals for their final operative work, and that was the general practice at that time. But it was found that most cases, every case, perhaps, that reached the base hospital was already in the stage of infection. Infection was already established; there was nothing they could apply at the front to prevent infection; therefore, every large flesh wound, every joint wound, every penetrating wound of the chest or abdomen, if they got that far, came down in infected condition, and the base surgeons had to treat not only the battle casualty, but also the superadded infection. The result was exactly as I told you. That was the reason they could not clean up these cases by the methods which had in the past been employed, and the first step—or, rather, there were two steps which were taken almost simultaneously; one was the attempt to clean the wound by new antiseptics and new methods; the other was the gradual moving of their operating centers from the base to the front, so they could operate on these cases in a period which may be said to be the period of contamination but not, necessarily, the period of infection. You know what I mean by the difference. A contaminated wound has a potential infection, but it is not actually infected. In other words, the organisms haven't gotten into the tissues, and if you can remove this contaminated and injured tissue and get a clean wound you can get a primary union. If you wait until the organisms develop in the tissues, the problem is more difficult and you can not clean that wound without removing a large area of tissue, pretty much as you would remove a tumor. These two factors have accomplished much. Carrel and his great work on antiseptics, and radical operation at an early period, have resulted in bringing about a great change in the success of wound treatment.

Now, Major Finney has spoken to you about the men doing their individual work wherever they are stationed, and he spoke to you about the front-area men and how important it was for the front-area men to do first-aid and transportation work, and not operative work.

I can not emphasize that too much. I remember seeing at one time just what that means to the wounded men who were being brought in. I will give you a description, very briefly, of what occurred July 31 at a British casualty clearing station at which I was stationed, just to show you what the problem is like. It is very easy for a surgeon to take care of one or two compound fractures in a day in civil life; we have plenty of time and assistance to do what is necessary, but out here, at times, we get cases so fast that one can't handle them that way, and we have got to use all our energy, and ingenuity, and work as fast as possible, often with insufficient assistance and material to do work that is efficient.

The casualty clearing station of the British, as you know, is a general hospital of about 1,000 beds, on an average, with 3 or 4 teams—surgical teams—and 1 or 2 tables working; but during a period of expected activity they send and get additional teams. This particular hospital had 8 teams and 8 surgical tables running. In ordinary conditions of quiet we would receive an average of about 200 cases a day—some were sick, some were sprains, some were cuts and bruises, and a few battle casualties. But as soon as that battle commenced, we began to get a great many more severe battle casualties. In the first 24 hours after that push began, back of ———, we got 903 battle casualties. We handled all those men with 8 surgical teams and 8 surgical tables. Every man worked 16 hours out of 24, but we couldn't begin to do the work that ought to have been done. These cases were brought up in automobile ambulances as fast as they could be unloaded. The men were brought in on stretchers into the anteroom, where their clothes were taken off, and any case that could by any possibility be sent back to the base was redressed and marked "evacuation lying" or "sitting" and never reached the operating room at all. Only those cases whose condition urgently demanded operation were operated on. These cases were undressed, pajamas put on, wound area cleaned, etc., and laid in stretchers along in a line. Every case that was very badly shocked or wounded had preference. Every table was going just as fast as it could, all day and all night; and it was discouraging to get a compound fracture to which under ordinary conditions one would have devoted an hour and a half or two hours, and feel that you were jeopardizing the life of somebody else if you didn't get through in 15 minutes. I remember one afternoon the chief surgeon was walking up and down, saying "Speed up, speed up; ante-operation ward full and 65 cases lying on the grass outside." I just mention that to illustrate one point, and that is the conditions under which you have to work during a battle. If these men had not been brought back promptly a great number would not have received any treatment at all. It was because they had adequate transportation; the advanced-area men did it so well, that all eventually got back. Many of us doing that work felt that we didn't do our best work; too many cases to give adequate attention, the attention that we felt they deserved.

Now, another point. Just in connection with that I want to speak of the multiple injuries. That forms one of the most extraordinary and distressing things about war surgery—the multiple injuries. Now, if a man has a compound fracture, all right; you can take care of it. If a man has a gunshot wound of the chest, all right. A man may have an abdominal wound; another man may have a head wound. You can take care of those. But supposing one man has all of them, what are you going to do? Any one of them may kill him. It is a serious matter, and at the same time you know you can only operate a certain number of hours or minutes on that man. This is one of the most difficult problems. Just let me tell you of two cases:

At one time we were getting a great many compound fractures from war wounds. A man was put on my table in pretty fair condition; that is, a fair color and a good pulse. He had been badly shot up, but his pulse was pretty good. He had a compound fracture of the left femur, a compound fracture of the right tibia and fibula, a penetrating wound of the left foot, a compound fracture of the humerus, a chest-wall wound, and a very deep wound of the neck. Doing the best we could, it took 45 minutes to get that first femur properly dressed. His whole leg had to be shaved, he had to be disinfected; we had to make a long incision, make a thorough débridement, and put on a Thomas splint. That took a long time. It took 45 minutes, working as fast as I could, to put up that compound fracture properly. Then we tackled the fracture of the leg; that took 25 minutes; then the humerus; and by that time the anesthetist said "I am sorry, Major, but this man is getting pretty

weak and you will have to quit." Still you have got to operate, but you can't operate after he is dead. Therefore, such cases present a great many problems. In these multiple operations we very often go too far and the man dies. Take a bad abdominal case. A man was brought in and sent to the resuscitation ward, where they are subjected to the most advanced methods of stimulating treatment. It took 24 hours before the man had enough of a pulse to warrant an operation. That man had in addition a bad compound fracture and an extensive flesh wound. They brought him in. I knew at the time there wasn't much chance. It would take 35 or 40 minutes for the abdominal operation alone. However, we performed the abdominal operation—worked as hard as we could and got him off the table as quickly as possible. For 48 hours his life hung by a thread. After a while he got better. But if at the time we had attempted the other operation, he would have died. I want you to get some idea of the stress at times at the front, and the work which is done by the British and the French under those conditions. You can not expect brilliant results in these cases. A man is called upon to do many of these almost hopeless cases. One of the great problems is to decide what to do and what to leave undone in these bad cases of multiple injury. They form the worst group. One had to decide promptly. You judge what will kill him first, if the abdomen; take that. Compound fracture next; take that. If you can do both, well and good; if not, operate on one and let the other go until his condition improves. By good judgment, however, many lives can be saved. Now, out of 903 cases, 8 tables can only take care of 150 or 160. What became of the other 740 or 750? Some died, most went to the base, and many of them, probably 400 to 600, with minor wounds. If we could have treated these lightly wounded at once, we might get primary union, and they would go back to the line in a couple of weeks. Others would have taken a much longer time. As it was, all of these men went to the base, and all suppurated. It could not be otherwise, as we had only 8 teams. The best group to treat successfully are the lightly wounded. They ought to have the best opportunity for primary union. Not one of them had it. No criticism of the British at all, because no one feels more kindly toward the British or has a greater feeling of sympathy for their difficulties than I have. They did not have enough surgeons; they couldn't get them; and, therefore, thousands and thousands of men lightly wounded had to be sent to the base and their period of convalescence went into months instead of days and weeks. That we hope to be able to avoid in our Army.

Now, that brings us to the real topic, and that is the surgical consideration of wounds of the soft parts. Lectures on wounds associated with fractures will be given by others, and other departments will be taken up by other men. I want to speak to you about wounds of the soft parts. This has to do with the entire question of the treatment, the aseptic and antiseptic treatment of wounds. Let us first consider the different types of wounds. If I repeat, I am sorry—you may already have had it, but I think it is important to call attention to the difference in these wounds. The wounds made by rifle and machine-gun projectiles, are perhaps the least important, in case they do not strike some vital organ or vessel. Why is it? Because at the present time, the modern, high-velocity rifle or machine-gun projectile strikes with such force and passes through the tissues and separates the fibers, rather than tears them, because it is a sharp-nosed bullet and carries very little with it, and often does very little harm unless it strikes an important organ or vessel. You shoot a man through the chest with a revolver and he is in bad shape; you shoot a man with a high-velocity bullet and it may pass through his lung and give rise to the minimum of trauma. That is because it carries very little with it; it separates the tissues rather than lacerates, and it passes in and out and produces a minimum of harm. That is true also of a machine-gun bullet. If however, you shoot a man at short range, the initial shock does very much harm; it causes destruction of tissue out of all proportion to the size of the bullet, on account of the explosive shock you get at short range. Now, on the other hand, if that projectile is fired from a long range, it begins to slow up, and instead of entering nose first, or point first, it will enter sideways. That gives you laceration, much destruction of tissue, extensive damage to the structures, through which it passes, out of all proportion to the other. The safest length is between the two.

The shrapnel bullet has an entirely different effect. It is never of high velocity—always of low velocity. As the shell explodes—and its theory is to explode above the heads of troops—it spreads in every direction. It is a larger bullet and carries in more clothing and

causes more contamination than the machine-gun bullet. It is not as destructive of bone as the high-velocity projectile. I didn't mention in connection with the rifle or machine-gun bullet that when it does strike a bone it breaks it into numerous pieces. A shrapnel bullet will only make a very small amount of comminution.

Now, next, shell fragments. Shell fragments produce more wounds, I think, than any other projectiles which we encounter in military surgery. At one place, at the hospital at ———, in 1915, we estimated that 80 per cent of our wounds were from shell fragments. We didn't get the very lightly wounded. But we estimated that 80 per cent of our wounds were due to shell fragments or other high-explosive missiles from grenades and trench mortars. They are irregular, sharp pieces of steel or other metal which by the explosion are driven with great force a short distance, but on account of their shape they produce the most extensive laceration of wounds that we come in contact with at all. There is a great amount of mutilation of tissue, and the nearer the victim is to the explosion the greater amount of damage produced by these irregular fragments. Now they vary. They vary from very minute little particles which you sometimes find. The little ones are not important, and by little I mean about a half centimeter in length and very flat. These are pretty common; sometimes you see a man with 100 such wounds. They do little harm in soft parts, but they may penetrate the abdomen and make perforations that one can not see. In one case I could hardly make a diagnosis. The man had abdominal symptoms; he had every possible pathognomonic sign. We said he must have a posterior wound, but he certainly has an abdominal injury. I went right through the rectus muscle and as I turned the abdominal wall over I said "There is no rupture of the peritoneum." At the same time I was saying that, I heard ziss-s-s, and I said "That sounds like gas." I explored him further, and from a piece of intestine that looked perfectly normal, I saw little fine bubbles, three small perforations of the intestine which had evidently been made by minute pieces. I call your attention to this for the reason that you won't see it in the reports or textbooks. Many of the British surgeons had never seen it. Another case occurred that same afternoon. There was a small wound on the anterior abdominal wall. You could see something had passed in there. He had exactly the same symptoms. The only way we could detect the perforation was by the bubbling gas.

Now that is the smallest shell fragment. From there on they increase in size until we get them almost any size. Some, of course, kill immediately, and we don't see them at the casualty clearing station. I have, however, seen them 6 inches across. They make some of the most difficult wounds to treat. I remember one night, three bombs fell back of our hospital and one very close to an officer's tent, and a great big piece of metal hit this officer, went through both buttocks, clear down to the bone. It was an enormous piece of metal. We operated on him and he came out all right. These illustrations show that you may have every conceivable size and shape of projectile from shell fragments, and they produce most vicious wounds of the soft parts and the bone skeleton.

Bayonet or saber wounds—I don't believe you will see many of them. I have seen only one bayonet wound in all my experience. That wasn't a thrust; it was a strike. The man had a bayonet on his gun and he struck his antagonist down. As for a saber wound, I have never seen any. I suppose they occur. Certainly lots of bayonet wounds occur, but I fancy they never get back to the hospital. A bayonet wound is a thrust wound. Of course, that's the reason. You can not run a man through the abdomen and expect to get him back to a base hospital; and unless they are through the extremities you don't see them. I don't know what becomes of them.

Buried injury: When a man is in a trench or dugout and a high-explosive shell bursts near, it is apt to bury him. I have seen a great many men come into stations that were asphyxiated. These fellows had been buried alive and dug out. You must remember that a buried man is a man who has been partially asphyxiated and a mighty poor subject for a general anesthesia. Local anesthetic should be given if you can, but don't give that man a general anesthetic if you can help it. Of course, I don't mean a man who was simply tumbled over in the dirt; I mean a man who was actually buried. Another thing about this question of being buried: They are very often in a state of great apprehension and shock. Buried under a load of earth is a very shocking procedure and it is often fatal. Just the other day we had a lot of men out in the front line and the boche were shelling them pretty severely, and one shell struck the earth near them and buried 20 men. The others began to uncover

them. One man was taken out alive, then 6 dead bodies; then another shell buried them again, and as far as I know only 2 or 3 of the whole lot got out alive. Just remember that fact: They are not good subjects for anesthesia.

Another type of accident—the airplane accident. A great many air men have their planes disabled and come down and hit pretty hard so that they have a good many of ordinary results that you see in civil life. Simple fractures, compound fractures, yes, but most of them simple, and you also get a good many cases of profound shock from the suddenness of the falling, but principally they are cases in which you get simple fractures. You don't get very many of them, but they are very apt to multiply. I remember one case that impressed me very much; not from a surgical standpoint, but from the bravery of the man. The man was brought in and put on the table. He had a compound fracture of the right thigh, lower leg, and arm. He looked badly. Pretty soon he said, "Has my partner come in?" I said, "I don't know." "My observer," said he, "was with me. How is he? Is he still alive?" We got this man off the table. The next lad they brought in had a fractured femur. He said, "Is my pilot here?" I said, "Were you the observer?" and he said he was. I said, "Well, he's all right; he's alive." He said, "That's good; thank God; that's one of God's noblemen." I said, "Why?" He said, "I think he is the bravest man I ever saw." He said, "We were 16,000 feet in the air; we were engaged by two boche planes. The machine was shot two or three times, and finally they shot off half our left wing, also hit our engine and tank. We volplaned down and were able to get about 500 feet over the line. If it hadn't been for that man's marvelous skill we both would have been killed."

Army Sanitary School No. 106.

BLOOD TRANSFUSION

By Captain Hussey

(Lecture and demonstration, fourth session of the Army Sanitary School)

Blood transfusion, like many modern therapeutic measures, is an old idea which has been recently developed into a practical and easily performed method. As a matter of fact an attempt was made at blood transfusion as early as the sixteenth century. During the past 10 years many efforts have been directed toward improving technical methods for this procedure. These have been so successful that now it is quite possible for blood transfusion to be utilized on a broad scale.

In reviewing the many methods of blood transfusion extant for the most practicable one to be used under conditions of war in the hospitals of the zone of activity, a committee appointed by Major Finney, chief consulting surgeon for the American Expeditionary Forces, gave due consideration to the many possibilities. These methods fall into two general classes, namely, the direct and indirect. In the direct methods the blood is allowed to flow from the vessel of the donor into the vessel of the recipient. This is accomplished either by bringing the endothelial lining of the vessels of the two people into apposition, or connecting the vessels by means of an especially devised tube. One can not judge the volume of blood transfused and there are many possible misfortunes for both donor and recipient. Moreover, such procedures entail unusual surgical experience. For many obvious reasons the direct methods were considered quite out of the question, so the matter resolved itself to the consideration of the best indirect procedure. It was thought very necessary to keep in mind that whatever method would ultimately be decided upon, it should be one simple enough to assure the possibility of a large number of men being easily and quickly trained to perform it, one that could be handled by one man, yet one which would give the best results. There are two groups of indirect methods, one in which the unmodified blood is transfused, another which utilizes some anticoagulant, thus disregarding the time element of coagulation. The unmodified blood transfusion methods are performed by the means of especially designed mechanical devices or the use of syringes. Obviously it would be impracticable to expect to supply a large enough number of any special instruments on account of the difficulties of manufacture at the present time, the syringe methods require at least two men for their performance. Furthermore, all these procedures require a certain degree of dexterity in handling them which could not be acquired as quickly as is desired in the present emergency; hence any wide application of blood transfusion would be quite impossible. Obviously, then, some indirect method, using modified blood, had to be decided upon. Experience has shown

that sodium citrate is the best anticoagulant to use for this purpose. Although there has been some controversy about the relative merits of modified and unmodified blood transfusion, the use of the citrate method has been very favorably reported upon, and in the hands of workers who have had opportunities to use both methods the results compare very equally. The citrate method was decided upon and adopted for development to be used among the troops of the American Expeditionary Forces.

AMOUNT OF SODIUM CITRATE

Regarding the amount of sodium citrate one can use, it is necessary, of course, to use a sufficient quantity that will prevent coagulation and at the same time be not of quantity sufficient to be toxic. It is generally accepted that a concentration of 0.2 per cent of this salt will prevent coagulation. Different workers vary from 0.2 to 1 per cent concentration for blood transfusion. We use a solution containing a sufficient quantity of anhydrous sodium citrate to give a concentration of approximately 0.21 per cent. There are three salts of sodium citrate to be obtained from the open market, the anhydrous salt $C_6H_5O_7 \cdot Na_3$, one containing 2 molecules of water of hydration $C_6H_5O_7 \cdot Na_3 + 2H_2O$, another containing 11 molecules of water of hydration $2(C_6H_5O_7 \cdot Na_3) + 11H_2O$. We make a 42 per cent solution of the salt containing 11 molecules of water of hydration; 5 c. e. of such a solution contains 2.10 gm. of the salt, which amount is equivalent to 1.518 gm. of an anhydrous salt. When blood is taken from an individual for transfusion it is received into a bottle containing 100 c. e. of physiological saline to which has been added the 5 c. e. of citrate solution, it is intended that 600 c. e. of blood be taken into this solution, which will bring the total volume to 700 c. e. Then in 700 c. e. of the blood-salt solution mixture we have 1.518 gm. of the anhydrous sodium citrate, enough to give a concentration of approximately 0.21 per cent. If, as is sometimes the case, the full amount of blood desired is not obtained, the concentration will, of course, be higher, but the actual amount of salt of course will remain the same, so after all it is a question of the actual amount of salt that is given rather than just the concentration. The citrate solution is issued in glass ampules; these are prepared by first putting in the solution then sterilizing in the autoclave at 15 pounds pressure for 15 minutes; the ampules are then sealed in the blow flame.

DONORS

A very important consideration in blood transfusion is the selection of individuals for donating blood. First of all such individuals must be free from any communicable disease, such as syphilis and malaria. Beside this, there are certain biologic incompatibility of bloods of different individual members of the same species, so it is quite necessary to determine the compatibility of bloods before an attempt at transfusion is made. The serum of certain individuals contains bodies called agglutinins and hemolysins which cause either the agglutination or hemolysis, or both, of the cells of other individuals. While these are not always coexistent, hemolysins never exist without agglutinins. It has been determined by a number of different workers who have matched the bloods of several thousand different individuals that all persons fall into one of four groups, the percentage of these groups are about as follows: Group I, 5 per cent; Group II, 35 per cent; Group III, 10 per cent; Group IV, 50 per cent. A very convenient way to impress your mind with the possible incompatibilities of these different groups will be to follow this diagram. Assuming that the sera contain bodies we call agglutinins or hemolysins represented as *a* and *b* and, that the cells contain substances we call agglutinogens or hemolysinogens represented as A and B, and that similar bodies act on similar bodies, then assume the distribution of these bodies in the cells and sera of the members of the different groups as follows:

Group	Cells	Serum
I	A, B	-----
II	A	<i>b</i>
III	B	2
IV	-----	<i>a, b</i>

In Group I the cells have the A and B bodies, a serum which will cause agglutination or hemolysis of these cells must have either or both *a* and *b* bodies. It will be seen that all other sera save that of Group I contain such bodies, so the serum of a Group I individual is the only serum which will be compatible with the cells of such an individual; therefore the blood of Group I individual could not be used for transfusion to an individual a member of any other group. Now in Group IV you see the cells have neither A or B bodies, so it will be impossible for these cells to be acted upon by the serum of an individual a member of any of the other groups. So the blood of an individual a member of Group IV can be used for transfusion to anybody. You will notice, however, that the serum of a Group IV individual contains both the *a* and *b* bodies, and one might think in view of this fact that such a blood transfused to an individual whose cells contain A or B, or both, bodies that such cells would be harmed. However, the high dilution that is made as the bloods become mixed renders this fact a negligible one. It might be said, however, that there are two kinds of incompatibility, a clinical and physiological; a clinical incompatibility would be one where the serum of the recipient contains the bodies that will affect the cells of the donor and must not under any circumstances be admitted. The physiological incompatibility would be an instance where the serum of the donor may affect the cells of the recipient in a concentrated suspension, but under the conditions of administration the mechanism will not be affected. In other words the rule to remember is that the cells of the donor must not be hemolyzed by the serum of the recipient. By applying this idea, you will see that it is possible to use the blood of anybody for a Group I individual; for this reason such individuals are spoken of as "universal recipients." Also you will notice that the blood of a Group IV individual may be used for the members of any other group; an individual belonging to this group is called a "universal donor." For Group II individuals it will be possible to use the blood of the same group or of Group IV. For a Group III individual it will be possible to use the blood of the same group, or Group IV.

There are several different methods for matching bloods to make these determinations—the one we have decided upon is a microscopic slide method devised by Doctor Vincent of Boston. In this method the serum of a Group II and a Group III individual are utilized; they have added to them sufficient sodium citrate to give a concentration of 1.5 per cent, also phenol 0.25 per cent. In most of the methods it is necessary to have washed cells and separated serum, the citrate is added to this serum so that whole blood obtained from a prick in the ear or finger can be used and coagulation will be prevented. Although the sodium citrate will interfere with the hemolysis, it will not interfere with agglutination. However, in view of the fact that hemolysins do not exist unless agglutinins do, the group determination can be made on the basis of agglutination alone. We have provided a glass slide which has the Roman numeral II in the upper left-hand corner and the Roman numeral III in the upper right-hand corner. One places a drop of each of the sera on the respective ends of the slide, then takes a small amount of fresh blood of the individual to be grouped and intimately mixes it with the serum on one end, and then another small amount of blood likewise with the serum on the opposite end; within a few seconds on one side or the other he may notice an appearance which resembles fine brick dust; this denotes agglutination. If this appearance occurs in the serum of Group II we know that such cells to agglutinate must contain the A bodies, so the individual whose blood it was could not be a Group II individual but must be a I or III, because it would be impossible for the serum to agglutinate its own cells or the cells of a Group IV, as neither of these contain the A body. If the cells were from a Group I individual, we should expect to find the serum of the Group III causing agglutination also because this serum contains bodies and Group I cells contain both A and B; therefore when both sera cause agglutination the individual being tested is a member of Group I, when the serum of either II or III alone agglutinates the cells the individual belongs to the group where no change takes place. If the cells are not agglutinated by either sera, the individual belongs to Group IV.

METHOD OF TRANSFUSION

The outfit designed to carry out this work consists of two boxes containing the necessary paraphernalia for performing every technical detail of the procedure. A large box containing glassware, rubber tubing, needles, etc., and a smaller box containing the laboratory outfit

for group determination, tags for identifying the individuals of the different groups, the citrate solution in ampules, solution for washing needles, and fluid for making red-cell estimations. When one of these outfits is received at a hospital where it will be used, the contents of the box will be prepared for use by being separated into units, each unit will be wrapped in unbleached muslin and sterilized as other surgical materials are prepared. When a transfusion is to be done, one of these large bottles will be unwrapped, 100 c. c. of sterile physiological saline solution will be poured into the bottle, and the contents of one of the ampules of sodium citrate solution emptied into it and mixed well. One unit marked "donor," consisting of a rubber stopper with two short right-angle glass tubes, one a little longer than the other, is fitted into the bottle, to the shorter of these two tubes a piece of rubber tubing is connected, and to the free end of this rubber tube a glass suction tube is connected. To the longer tube a piece of rubber tubing, about half as long as the rubber tubing just mentioned, is attached; at the free end of this tubing a needle of 25 or 20/10 mm. bore is adjusted, the apparatus is then ready for receiving the blood. The arm of the donor should be cleaned, a tourniquet placed just above the elbow just insufficiently tight to prevent arterial circulation, the veins of the forearm will now be seen to stand out prominently. One of these is selected for puncture, the skin over it is painted with iodine and then a venous puncture made to obtain the desired amount of blood. While the blood is flowing into the bottle one should rotate the bottle so that an intimate mixture of blood and citrate salt solution be effected. Suction through the glass tubing with the mouth will facilitate the flow of blood. The rubber stopper with the glass tubes is now removed and in its place is put the rubber stopper with two tubes from the package marked "recipient." One of these tubes is very much longer than the other, reaching nearly the bottom of the bottle. To the exposed end of this glass tube a long rubber tubing about a meter in length is attached and to the free end of this tube a small piece of glass tubing is attached. To the exposed end of the short tube a piece of rubber tubing of medium length is attached and to its free end a small glass tube containing a pledget of cotton is fitted. A needle of about 13/10 mm. is now selected and attached to a very short piece of rubber tubing. One blows through the tube connected with the short glass tube until the blood mixture reaches the end of the glass tube attached to the long rubber tubing, a clamp is now fixed on the rubber tubing until the needle has been successfully placed in the veins of the forearm of the recipient, the forearm having been previously prepared as in the instance of the donor. The rubber tubing attached to the needle is now connected with the glass tubing of the long rubber tubing, the bottle is elevated, the clamp released, and the blood allowed to flow into the vein of the recipient after the tourniquet has been removed. One should allow from 10 to 15 minutes for this amount of blood to be received by the recipient, or a longer time if conditions seem advisable. It must be remembered that if the blood mixture be allowed to flow too rapidly so much fluid may be taken into the venous circulation in such a short space of time that the right heart may not be able to accommodate it; this will be followed by unfortunate results. Quite frequently, with an individual suffering from shock or hemorrhage, the blood pressure may be so low that it will be quite impossible to get distention of the veins by the use of the tourniquet; in such cases it will be necessary to cut down on the vein and use a cannula; there are two cannulae with each outfit for this purpose.

It might be thought that the needles advised for obtaining the blood from the donor are rather large, but where such a large amount of blood is to be obtained it is quite necessary to use a large needle. There will be no difficulty experienced if the needles are well cared for and kept sharpened; so frequently one encounters a good deal of difficulty in entering veins on account of using dull needles, we have in each outfit sharpening stones to be used by the operators so that they may have no difficulty in having their needles properly sharpened. Very frequently a needle may look perfectly well sharpened, but when it is examined with a low-power lens under the microscope, one will notice it to be very defective. It is, therefore, a wise procedure to resort to this before putting a needle into a tube for sterilization for future use. After each transfusion, the needle should be washed with distilled water, then 95 per cent alcohol and finally with ether; then thoroughly dried, carefully examined, and sterilized with dry heat.

INDICATION FOR BLOOD TRANSFUSION

Blood transfusion is advised in all cases of shock and hemorrhage whether existing alone or in combination. It is particularly desirable that the transfusion be done as early after injury as is possible. The best indication for determining the necessity for transfusion is the blood pressure; in any case where the systolic blood pressure is 80 mm. or below, transfusion should be done immediately. However, in cases where there are severe abdominal injuries or other injuries to other parts of the body where bleeding may commence as soon as the blood pressure is elevated, the transfusion should not be done until the patient is on an operating table where a surgeon will be ready to control such hemorrhage with the greatest facility. Some very interesting work has been accomplished in the study of shock by Maj. W. B. Cannon, M. R. C., and it will be your privilege to hear about this work directly from him in a talk which he is to give you at some later date. Blood transfusion may be said to be only one, but perhaps the best of several methods used for the resuscitation of a wounded man suffering from shock or hemorrhage. It should be practiced as often as it is possible; it should be made possible at all times.

RESUSCITATION WORK FOR THE WOUNDED OF THE AMERICAN EXPEDITIONARY FORCES

In view of the fact that blood transfusion as well as other methods of resuscitation will have wide application among our wounded troops, it has been thought advisable to have men especially trained for carrying out this work. Such men will be selected from the medical men; they will be sent in groups of about six to the central Medical Department laboratory, where they will receive a course of instruction which will familiarize them with the experimental facts which serve as a basis for the application of the various resuscitation methods and the technical procedure for carrying out such methods. Such men will be placed in evacuation hospitals and base hospitals; they will group a large number of possible donors, selected from the healthy individuals of the enlisted personnel who will be willing to donate their blood when it is needed. A record of such men will be kept where it can be referred to at any time. When a convoy of wounded arrive at the hospital, the individuals who apparently may need blood transfusion will be placed in a ward where they can be given the special attention necessary for such cases, shock bed, etc. These individuals will be grouped; blood will then be obtained from some of the donors and transfusion can be done at any time. It is even hoped that we may be able to have men placed in more advanced aid stations where, although blood transfusion is not practicable, other resuscitation methods are, and men who have had training and experience will have acquired a degree of physiological judgment which will enable them to save the life of many a wounded soldier who perhaps would die before reaching an evacuation hospital, or would at least be in such an advanced state of circulatory collapse that his condition would be hopeless and perhaps he would die a short time after reaching the hospital.

CONCLUSION

It is hoped that this work will be met with a great deal of enthusiasm and that each and every member of the Medical Corps will cooperate with those who are making this effort to save many lives that under ordinary conditions would undoubtedly be lost.

Army Sanitary School No. 108.

PYODERMIA OF PARASITIC ORIGIN ^a

By Capts. H. C. Semon and H. W. Barber, R. A. M. C. (T. C.); (furnished by Major McCormick)

It is impossible to work for any length of time at a military hospital for diseases of the skin without being impressed by the large preponderance of pyogenic infection.

Thus, out of a total number of 669 patients admitted under our personal care, between April 1 and May 9, 1917, 631—i. e., 94.3 per cent—were cases of this nature.

^a For the purpose of this article it is proposed to use the word "pyodermia" to indicate the various types of lesions denoted by the terms "impetigo," "furunculosis," and "ecthyma."

Among soldiers, pyoderma of the scalp, face, and neck, is usually associated with the seborrhœic diathesis (Darier's "Kerose"), whereas, when it occurs on the trunk and limbs it is, in our opinion, almost invariably the result of a concomitant or preceding parasitic infection, viz, scabies of pediculosis.

It is the object of this paper to establish the parasitic aetiology of pyoderma of the trunk and limbs, to emphasize the striking differences in the clinical pictures produced by the acarus and the louse, and to describe briefly the therapeutic measures which, in our hands, have yielded the best results.

There is seldom any difficulty in recognizing pyoderma due to scabies, even though there be no active lesions present. The distribution of the eruption, or of what remains of it when the case comes under observation, is highly characteristic.

As it is of paramount importance in the differential diagnosis of the various types of pyoderma, we may be pardoned for briefly recalling the main features of the scabietic eruption.

SCABIES

For descriptive purposes we propose to consider:

- (1) A case of early scabies.
- (2) One in which secondary pyogenic infection has occurred.
- (3) One in which the affection manifests itself in a subject with the seborrhœic diathesis.

(1) To meet with cases of early and uncomplicated scabies in troops fresh from the trenches is exceptional, as pyogenic infection is a rapid and almost constant sequel.

In such, burrows and vesicles, if present, can most easily be demonstrated on the hands, especially along their ulnar borders, and between the fingers; on the flexor aspect of the wrists; on the prepuce and glans penis; and on the ankles and dorsum of the foot.

(2) When secondary infection has occurred, papules and superficial pustules and boils make their appearance, not only in the above situations, but also in the extensor surface of the elbows, the anterior axillary folds (where they are sometimes associated with burrows) round the nipples, and very commonly around the umbilicus, and on the lower half of the buttocks. On the lower extremities the eruption is most evident on the posterior and internal aspects of the thighs, the anterior aspect of the knees, the popliteal space, and behind the malleoli.

It is also worthy of remark that long after all evidence of active infection has subsided, chronic pauciginous papules tend to persist in certain situations, particularly the wrists, the inner surfaces of the thighs, the buttocks, and on the scrotum and penis.

A feature of the scabietic eruption that has helped us in doubtful cases of pruritis and pyoderma—and one, the importance of which we particularly desire to emphasize—is the peculiar goose-like appearance of the affected cutis in general.

On examination with a lens this appearance is found to be due to the erection of the pilo-sebaceous follicles, and in our experience it is an almost constant, though unexplained, phenomenon in scabies.

(3) Where the exudative seborrhœic diathesis exists, infection with scabies is usually associated with a severe and widespread eruption. The acarus is one of the most potent agents in provoking and lighting up an acute seborrhœic dermatitis in persons thus predisposed, which is not infrequently mistaken for the dermatitis excited by the injudicious use of sulphur.

(N. B.—On the other hand, seborrhœic subjects are particularly liable to suffer from sulphur dermatitis.)

The eruption begins as a discrete papulo-follicular eczema confined to the erected pilo-sebaceous follicles already described. Later, confluence takes by the eczemization of the intervening skin, the discrete follicular appearance is lost, and diffuse patches of eczema, which may later coalesce to form large plaques, make their appearance.

These characteristic lesions may be generalized, but tend to be most severe and persistent on the forearms, the inner surface of the upper arms and axillæ between the scapulae, on the lower abdomen, on the inner surface of the thighs, and in the popliteal spaces. In this type of case, seborrhœic eczema of the face and scalp coexists, and is apt to prove a trap to those who have hitherto believed that facial eruptions preclude a diagnosis of scabies.

PEDICULOSIS

The conditions under which our troops have been fighting are responsible for the occurrence of cases of pediculosis, far more severe and extensive than are commonly seen in civil hospital practice. There is no doubt whatever that in this connection the *P. vestimentorum* or *corporis* is the chief offender. It is rare to find *P. pubis* while *P. capitis* is still more uncommon. We will, therefore, confine our remarks to the *P. vestimentorum*. The following description of the main external characteristics of the parasite is taken with acknowledgments from that excellent monograph, *The Louse Problem at the Western Front*, by Lance Sergt. A. D. Peacock:^a

The female is about 4 mm. in length, the male about 3 mm. The head bears one pair of antennæ, and the black eyes. The three thoracic segments are fused and present but little demarkation. There are 3 pairs of strong legs attached to the thorax, each of which terminates in a short powerful spine. There are 8 abdominal segments, the 3 terminal being fused. Posteriorly, the male is pointed, and the penis may sometimes be seen extruded, whereas, in the female, the posterior end is bilobed, and bears a pair of ventral copulatory organs.

It is well known that the female deposits her eggs in clothing of all sorts and in blankets, and most of the prophylactic measures against "lousiness" have been directed to the sterilization of the soldier's kits. It does not appear, however, to have been generally realized that the *Pediculus vestimentorum*, like the *Pediculus pubis*, also almost invariably attaches its eggs to the pubic and perineal hairs, and less commonly to those of the axillæ and other covered hairy regions. In no available textbooks or monographs to which we have had access is this fact referred to, although its importance is at once obvious and far-reaching.

Some months ago one of us (H. S.), in examining seven consecutive cases of ecthyma and furunculosis of the lower extremities, happened to notice in each of them the presence of "nits" on the pubic hairs, and from this time forward we have made a point of carefully examining the pubic and axillary hairs in every patient that has come before us.

(1) In almost every case presenting any or all of the lesions we have learned to associate with pediculosis, "nits" were found either in the pubic, axillary, or perineal hair.

(2) In cases of pediculosis in which new lesions developed while the patients were actually under treatment in hospital, careful search of the above-mentioned hairy regions almost invariably revealed the presence of "nits" which had escaped the attention of the orderly in charge of the case. Removal of these, the application of paraffin, or 1 in 40 carbolic lotion, and a complete change of kit were always successful in preventing the further appearance of fresh pustules.

It may here be said that until we realized the importance of the pubic and axillary hairs as breeding places for lice, our cases of pediculosis were constantly developing new furuncles (i. e., infected bites); now that we insist on the pubic and axillary hair being cropped, and all "nits" removed with paraffin, this no longer occurs. The cases are consequently cured in a very much shorter time.

(3) Although *Pediculus pubis* is occasionally met with, and when present is usually found both on the pubis and in the axillæ, in the vast majority of our cases the eggs in these regions were those of the *Pediculus vestimentorum*.

We were first led to this conclusion owing to the frequency with which live specimens of the *Pediculus vestimentorum* were found crawling among the egg-laden hairs, particularly on the pubis, although *Pediculi pubis* were absent.

We have since succeeded in hatching out young *P. vestimentorum* from hairs removed from the pubis, and kept at body temperature for several days. This experiment conclusively proves that the *Pediculus vestimentorum* habitually lays its eggs on human hair, and this fact should always be carefully considered in undertaking prophylactic measures against louse infection.

We may now consider the different lesions met with in association with pediculosis. Apart from the actual bite of the parasite and superficial scratch marks, there are three main types.

^a *Brit. Med. Jour.*, 1916, i, pp. 745, 784.

- (1) Superficial pustules and boils.
- (2) Circular encrusted lesions of varying depth.
- (3) Very characteristic linear lesions, presumably a sequel to (2) and the superficial scratch marks above mentioned.

Scratch marks are most commonly situated on the shoulders, chest, buttocks, and sacral region, upper parts of thighs, both internal, anterior, and external surfaces, and on the legs. The excoriations correspond in their different situations to the lines along which the patient can most easily scratch himself ("grattage instinctif,"? Dubreuilh). Thus on the buttocks they tend to radiate upward and outward from the anus. On the outer surfaces of the thighs they run vertically upward, on the inner surfaces upward, and outward, and similarly on the sacrum.

At this stage it is interesting to compare the scratch marks of scabies with those caused by the *pediculus*. We have already referred to the erection of the pilo-sebaceous follicles in scabies, and in this disease the scratch marks appear as minute pinpoint blood crusts at the apices of the erected follicles, whereas, in pediculosis, in which no such follicular erection is seen, the scratch marks are merely linear excoriations of the otherwise normal epidermis.

(1) *Pustules (superficial); boils (deep)*.—Our observations would lead us to believe that a superficial or deep pustule is the initiatory stage of the other lesions met with in pediculosis. The sequence of events is as follows:

(a) An indurated irritable bright-red halo arises around the original bite. In the center of this a minute yellowish-white vesicle, rapidly drying to form a crust, makes its appearance.

When pressure is applied to a superficial lesion at this stage, a small quantity of pus is exuded from the central vesicle or crust. In the deep variety (or "boil"), which is often elevated and surrounded by a wide area of induration, similar treatment results in the forcible projection of a considerable quantity of sanguineous pus, from what is evidently a bottle-shaped cavity. In both types of lesion the superficial opening or mouth is very minute and of definitely circular outline, a fact that supports our view that these pustules are originally formed round punctures made by the parasite.

If the pustules are dealt with in this early stage by ordinary antiseptic applications (e. g., tinct. iodi.) they usually involute without progressing further, but, if not interfered with, the lesions tabulated under (2) are apt to result.

(2) *Circular encrusted lesions of varying depth*.—It is not difficult to trace the progressive development of ulcers of varying depth and extent (as may be seen by a reference to the accompanying photographs) from the pustules above described.

(3) *Linear impetigo*.—Superficial linear encrusted lesions result from the exudation of serum along the lines of excoriation due to scratching; they may occur in any pruriginous complaint, and are in no way especially characteristic of pediculosis.^b On the other hand, the variety which is pathognomonic of louse infection is a gutter-shaped ulcer covered by a brownish crust, and of considerable depth. Its outline varies with the stage of its development which, in our opinion, proceeds from the longitudinal digital excavation of one of the circular ulcers above described; and, in fact, in a severe case of pediculosis, all the intermediate stages between the circular and the rectangular gutter-shaped ulcer, so-called "impetigo linearis," can easily be demonstrated (vide photographs).

These circular and linear lesions when healed are invariably replaced by bluish stains and brown pigmentation which persist a long time, or if sufficiently deep, by the formation of actual scar tissue.

DIAGNOSIS

The chief points in the differential diagnosis of the eruptions due to scabies and pediculosis may now be presented in a tabular form.

^b Major MacCormac and Captain Small have recently drawn attention to the fact that superficial "linear impetigo" may be a manifestation of what they aptly term a "war neurosis." It is frequently associated with anesthesia of the palate, altered cutaneous sensibility, and other stigmata of the psychopathic state.

Localization

SCABIES

Hands, wrists, elbows, anterior axillary folds, umbilicus and abdomen, lower triangular area on the buttocks; penis and scrotum; front of knees, ankles, and feet.

PEDICULOSIS

Posterior axillary folds, shoulders, sacral region, and upper part of the buttocks, groins, thighs, and the skin between knees and ankles.

Type of lesions

Burrows, vesicles, small superficial crusts, papules, pustules, and a specific erection of the pilosebaceous follicles with secondary eczematization, especially in seborrhoeic cases. Scratch marks are represented by minute blood crusts at the apices of the erected follicles.

Superficial and deep pustules with a surrounding red and indurated halo. Circular encrusted ulcers of varying depth and size, but on the whole very much larger than those met with in scabies. "Linear impetigo."

It is obvious that since infection with both the parasites is quite common, the two clinical pictures may be superimposed.

PROPHYLAXIS OF PEDICULOSIS

It is beyond the scope of this paper to supplement by other suggestions the measures for the disinfection of blankets and clothing at present in use at all general hospitals and military cleansing depots in France. We would, however, emphasize the extreme importance of simultaneously eradicating the reservoirs and breeding places on the human body itself (as is done in scabies), for which purpose baths, medicated or otherwise, are not sufficient.

If these are overlooked, it is obvious that there is every likelihood of a rapid reinfection of the sterilized garments within a short time of their reissue. We have found the cropping of the pubic hair and the repeated application of paraffin, or 1 in 40 carbolic lotion, to the pubis, perineum, and axillæ quite effective, although there is no doubt that, if it could be supplied, petrol (which is used for this purpose in the French Army) would be the most powerful agent, as it not only kills the adult parasite instantly, but also penetrates the chitinous envelope of the ovum and detaches it from the hair.

An improvement on petrol is the solution of naphthalene 1 per cent and sulphur 1 per cent in benzol or petrol, recommended as of proved efficiency by Capt. J. A. Gunn in the *British Medical Journal*, May 5, 1917.

This solution is not only prophylactic to garments momentarily steeped in it, over several months, but is, as we are informed, and have ourselves proved, instantaneously lethal to both parasites and their eggs.

TREATMENT

In soldiers the routine treatment of scabies has already been exhaustively dealt with in this number of the *Journal* by Maj. H. MacCormac; it is therefore unnecessary to discuss it here.

The most important point to be observed in the treatment of pediculosis is the discovery and elimination of the parasite and its eggs.

The methods found efficient by us have already been described. It now remains to mention briefly our methods of treating the secondary lesions.

If the primary pustule is of small or moderate size, expression of the contained pus and painting the surrounding skin with iodine is almost always sufficient to insure resolution.

When ulceration and crusting have occurred, there is nothing which in our hands has yielded better results than an ointment of the following composition:

Acid salicyl.....	}	aa gr. x.
Sulph. precip.....		
Ung. hyd. ox. flav.....		ad one ounce.

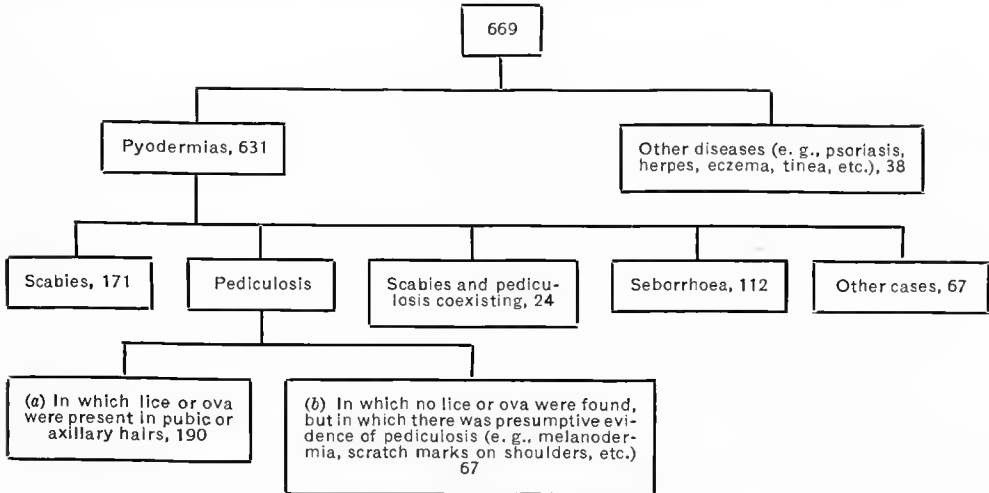
This is kept applied day and night on linen or lint, and in from four days to a week the superficial ulcers will be found, in the majority of cases, to have healed completely. Deep

ulcers of an ecthymatous type also do well under it, especially if the patient is kept in bed with his legs raised. It is only occasionally that we meet with the deeply eroded indolent variety. These have to be treated on general principles with the patient in bed, and will tax the therapeutic resources and skill of the physician to the utmost.

INCIDENCE

The views which we hold on the great importance of the pediculosis as a cause of disability are strongly supported by the figures we submit below.

The results of our analysis may be tabulated as follows:



Total number of cases, 669, were admitted between April 1 and May 9, 1917.

These are the combined results of our independent observations; the individual figures were as follows:

	Scabies	Pediculosis		Scabies and pediculosis	Seborrhoea	Other cases of pyodermia	Other cases	Total
		(a)	(b)					
H. C. S.	101	83	44	11	51	42	14	346
H. W. B.	70	107	23	13	61	24	24	323

Thus the various totals correspond fairly closely under each heading.

It will be seen that out of a total number of 631 cases of pyodermia, 452 were associated with parasitic infection; i. e., 71.6 per cent. Of these latter, 171 (i. e., 37.6 per cent) were consequent on scabies alone; 257 (i. e., 56.9 per cent) were apparently secondary to pediculosis; while in 24 (i. e., 5.5 per cent) the infections were coincident.

The preponderating percentage of the pediculous cases is at once apparent. Of the remaining nonparasitic cases of pyodermia, seborrhoea which is common and of a severe type among our troops—accounts for the majority, whilst in only 67 could no definite cause be assigned. We are therefore justified in assuming that parasites are responsible to a very large extent for the disability induced by skin diseases in this war.

CONCLUSIONS

(1) The disability produced by parasitic infection is very considerable. Of 669 cases admitted in just over five weeks, 442 were directly attributable to scabies and pediculosis.

(2) Of these 442, 171 were due to scabies alone, 24 to the combined infections, and 257 to pediculi.

(3) The *Pediculus vestimentorum* can, and in a considerable majority of cases actually does, lay its eggs in the hair of the pubis and perineum, and sometimes of the axilla.

(4) From this fact there arises the important deduction that measures directed toward sterilization of the clothes can not be efficient, unless the host himself is also disinfected at the same time.

(5) We regard it as extremely probable that the lesions of the pediculosis are initiated in susceptible individuals around the actual bite of the louse.

(6) The severity of the lesions produced, especially in the case of scabies, is very considerably aggravated by the seborrhœic diathesis.

(7) Rapid recovery in pyoderma associated with either scabies or pediculosis is the rule, provided that the respective causes are recognized and dealt with in an efficient manner.*

NOTE.—At this point in the pamphlet is a page containing a print of two photographs denominated "Figure 1" and "Figure 2," taken from the *British Journal of Dermatology and Syphilis*, Volume XXIX, Nos. 7-9, "To illustrate Capt. H. C. Semon and H. W. Barber's article on pyoderma of parasitic origin."

Next appear two photographs (3 and 4) taken from same book and volume as above. Same for Figures 5 and 6.

At page 11 of the pamphlet appears the following:

DESCRIPTION OF FIGURES

Fig. 1.—A case of scabies which demonstrates what is meant by follicular erection. The minute blood crusts on the apices of scratched papillæ are well shown, and there are obvious linear excoriations on the posterior and internal aspects of the left thigh. Most of the secondary infection is limited as can be seen, to the lower half of the buttocks. This picture should be compared with that of "linear impetigo." Note in the latter: The absence of follicular erection; the more scattered and larger size of the lesions; the linear or radiating tendency (*grattage instinctif*).

Fig. 2.—A well-marked example of so-called "linear impetigo"—"*grattage instinctif*." The origin was undoubtedly associated with pediculi, which were present in the pubic region. Note the radiating character of the lesions on buttocks. The crusted lesions, on the left buttock particularly began as boils. Subsequent ulceration of these has taken place, and in the picture can be seen lesions in all stages of transition, from a small ulcer to the linear gutter-shaped excavation with approximately rectilinear outline.

Fig. 3.—The pediculosis lesions are here displayed in several stages. Above the right iliac crest (and somewhat out of focus) is a late stage of the superficial circular ulcer (2 in text). On the right buttock, and in close proximity to the center of the natal cleft, is an abortive example of the type described under 3 in text. The remainder partake of the characters described in detail under the heading of superficial pustules and boils.

Fig. 4.—An absolutely characteristic picture of pediculosis. Note the localization and the appearance of the lesions: (1) An early pustule; i. e., infected bite, with the central yellow vesicle. (2) The central vesicle has become a crust covering a small underlying ulcer. (3) Infection is spreading peripherally along the lymphatics, and the circular ulcer is thus being produced. (4) The circular encrusted ulcer.

Fig. 5.—Two early boils which our experience has taught us to recognize of pediculosis origin. They were situated on the fore and upper arm of a patient with marked evidence of "lousiness" on the rest of his body.

Fig. 6.—Pediculosis boil on the anterior surface of the thigh. A crateriform ulcer is in progress of being formed. The characteristic, circular, crusted lesion would ultimately result.

* We have been asked to explain the fact that whereas about 90 per cent of all troops in the trenches are infected with lice, only a relatively small proportion (the exact figures can not, of course, be given) present the secondary lesions we have described. It can be contended that there is an individual susceptibility in some cases, such as has been proved to exist in the case of flea bites (Boycott) and those of mosquitoes and other insects. In other case the phenomenon of anaphylaxis probably plays a part, so that the susceptibility of the individual, as evidenced by the appearance of the lesions, is at first latent. That some specific toxin is injected by the louse when feeding is supported by the fact that in marked cases of melanoderma associated with pediculosis even the mucous membranes may become pigmented, as in Addison's disease (Thibierge and others). Darier, moreover, points out that it is not rare in such cases to find a marked cachexia with very real asthenia, a fact which we have ourselves observed on more than one occasion. Another factor in the production of the secondary lesion is, in our opinion, the coexistence of the seborrhœic diathesis, which, as we have already pointed out, plays such an important rôle in the severe eruptions primarily due to the *Acarus scabiei*.)

Army Sanitary School No. 109.

SHOCK

By Maj. George W. Crile

I will not dwell very much on the pathology and some of its interesting points and manifestations, but will take up with you, if you please, some of the practical considerations of shock such as one sees in the surgery of war. Now, let me first of all mention some of the salient facts. You will find that shock is quite different under some conditions of battle from shock under other battle conditions. We have always thought of shock as following and being caused entirely by injury; as a matter of fact that is only a part of the shock. We might first of all consider just what shock consists of, the main points in the man himself who is a victim of shock.

A man in shock is self-diagnosed; it is patent to everybody that he is in shock. The outstanding things in his condition that make everybody know he is in shock are these: First, the man is in prostration, and by prostration we mean that he is unable to walk, that he has muscular prostration, and that has loss of mental power as well. He is able to answer questions, give his name, and perhaps talk about very simple things, but unless you make a little more searching inquiry, you will not realize that the man has lost very much of his mental power. A man in shock can not for a moment undertake the solution of a mental problem; if he were the commanding general of a division he could not do much commanding; if he were a mathematician he could not figure out a mathematical problem; he has lost mental as well as muscular power. These are the great outstanding things. The next is that he has also lost the power of producing body temperature. You will find that his temperature steadily falls and keeps falling until death; 1, 2, 3, or even 4 degrees. Very roughly speaking we say that a man in shock is in prostration, and the three great signs are: (1) Loss of muscular power; (2) loss of mental power; and (3) loss of the power of fabricating heat.

Now, we can develop that just a little further: The man that has lost muscular power lies down—he doesn't walk or sit down, he lies prone; and the man who has lost muscular power will exhibit certain signs; for instance, a shrunken face. Have you ever seen a man sleeping heavily; you may not have been sure at first whether he was dying or only sleeping; his face is shrunken and his whole expression changed, and all that is due to the loss of power in the muscles of expression of the face. In the same way a man who is in shock and has a total loss of muscular power has also lost the power of facial expression; and of course the man who has lost muscular power naturally relaxes to a certain extent, and the circulation and the blood pressure tend to fall.

Now, we all know perfectly well, when the muscles are not in use and when the normal muscular tone is lost, from whatever cause, that the individual has by so much lost the power of producing heat. We must bear in mind that in normal times, in quiet periods, 50 per cent of the heat of the body is fabricated by the muscles and that in activity 75 per cent or more is created by them. Therefore, a condition that deprives the muscles of their power of operating ordinarily tends at the same time to deprive the muscles of their power of creating heat. Furthermore, the underlying condition that deprives them of their power to do work or produce heat also interferes with the action of the brain in performing its function. I might go on in this way, but it isn't worth while.

In total shock these functions are practically all suspended; so the three great signs are (1) loss of muscular power, (2) loss of mental power, and (3) loss of power of fabricating heat. These are the three great big outstanding factors; there is loss of many other functions but we do not count them because they are not important.

Starting with these facts, let us see how we can build up our picture. Now, what are the factors which will produce, altogether outside of war, this loss of mental and muscular power and loss of power to produce heat? We know very well that in starvation there is a loss of all these functions, so we may say that loss of food may be one. The loss of drink may produce the same result; you may have all of these things when there is a large hemorrhage in which the circulation of blood is not properly vitalizing the tissues of the body. All these will do it. We know that there is loss of circulation and mental power in an individual who overexerts himself, like a marathon runner, like a swimmer; so that you may exhaust your-

self in such a way that you are not able to do work. The same thing is true in passing through an anesthetic; you have the same loss of power, only more so. There runs through the whole gamut of these things a certain sequence of events, one after another.

Now, we can just as well start our point of attack by considering what it is that a man requires to remove fatigue after running, and you will find—rest. He comes in breathing rapidly and in a state of collapse—you have seen them fall as a result; and that man, that same man, could not solve a mathematical problem, he could not command an army, he could not commit a poem to memory; he is exhausted in every other way except that in his case you don't notice that the temperature falls so low. There is a general agreement that in these states there is created a very decided acidosis. That acidosis is created also by emotion, in animals or men, just the same as from running or from injury, or from a hemorrhage, for in every one of these things you find acidosis.

What do you mean by acidosis? We mean this, and it is a very important factor that concerns us here in our Army work: We, being in a normally balanced state of nutrition, have always a margin of safety between acidity, which causes disease and death, and the proper degree of alkalinity of our blood. It is hard for us to realize that man and animals can only live in an alkaline medium, but we must first of all accept this as true. Every moment that we live the body is producing acids as it transforms blood into energy; to live and perform the functions of the body we are always producing acids. There is thus always a battle going on between life and death, and among other causes, if for any reason the body is not kept neutral, as it were, from the blood all the way through—kept either neutral or alkaline—death takes place in animals and men. Therefore the man who is in the front-line fighting, as you see, is subject to the most common causes of acidosis. There are many factors in the body to prevent acute acids from occurring, but at times it occurs; and whether in shock it is cause or effect doesn't matter; but in the state of shock one of the most fundamental facts is that you have a very marked acidosis—always, always. Now, gentlemen, this is one of the salient facts concerning a man in fatigue from running: Rapid respiration is produced; and in running and in shock and hemorrhage the respiratory rate is governed by the state of acidosis always. It is the acid in the blood which drives the respiratory center to do its work; so when the respiratory rate is increased you know that this is in response to acidosis, or, better stated, to a diminished alkalinity. The striking peculiarity in shock, you see, is an increased respiratory rate, oftentimes very rapid. You have seen that. That is the first diagnostic point.

Then the next thing very striking about the man in shock is the fact that he has a low blood pressure. At the very beginning of the appearance of shock his pulse rate may not be very high; I have seen many with a pulse rate of 80 to 90. But after a while the pulse rate becomes very rapid, and the blood pressure is low. Blood pressure is always lower in shock—always; you do not have shock unless you have a low pressure. Even though the pulse is slow or normal, you will notice without even using an instrument that the blood pressure is low. Oftentimes there is entire failure of circulation and there is no pulse at the wrist at all; circulation fails. The man is nearly always sweating—hands cold, clammy; there is no force to the circulation and the muscular tone is gone; his face is shrunken and pale, sometimes ashen. These are the main things you see.

With this little sketch of some of the manifestations of shock, let us connect it up with our subject. Your soldier, if he is fighting in trench warfare and just happens to get injured, presents one picture; it is a very different thing if that soldier is in a battle, in a tremendously big engagement and a long fight. I want to dwell upon this point because it is the gist of the whole thing. Now in order to do that, just for a minute consider what the man's physical condition is, what the state of his mental activity is, and the state of his nutrition in battle. For example, I happened to have the opportunity of serving in a very active British army behind the lines during the past year, and in that capacity I had the opportunity of seeing a vast number of cases of shock and exhaustion and was given the opportunity of treating them; I also took the opportunity at the same time of finding out what they went through before they were injured. We can not consider this condition intelligently until we appreciate what they went through before being struck, and let me remind you that often you find a very bad case of shock in a man with an extremely light wound. Now, the man who has

gone through what I am about to describe to you may come down with shock from a very small wound, and that is the most dangerous type there is. The man with another type I am going to describe also, will take an enormous injury and hardly have any shock at all. That is the most hopeful type.

I am going to repeat some perfectly patent things to you, but without them I can not build up the picture I want to present. In the first place the enemy sets down a box barrage so that the soldiers are cut off for one day, or two, or three or four from their food supply or drink; they are extremely thirsty and they are not getting sufficient food. That by itself in an animal kills, if it goes on long enough, and before death there is an increased acidosis from fatigue and exhaustion which would be a similar thing to shock, only it takes a longer time. Say a man's resistance represents 100 per cent from his maximum margin of safety to his final collapse. A certain percentage of that would depend entirely upon the fact as to whether or not he got his supplies, whether they were held up by a barrage that cut him off so he didn't get food or drink for one, or two, or three days; a certain percentage of the exhaustion is due to that alone. That's first.

Secondly, we know very well that loss of sleep will kill any man or any animal, usually after the period of five days—loss of sleep alone. We can put a man in this room with all the food and drink he requires, a comfortable bed and perfect quiet, and without being bothered by a lecture or anything else he would die in four or five days from want of sleep. Now, each hour that you are awake beyond the period of time of normal resistance cuts off a little bit from the sum total of the factor of safety you possess; so that if a man is kept awake all night long and the next day and three or four days or so in his tour of duty in the trenches, and so has insufficient sleep, by just so much has that man's factor of safety been lessened, destroyed, and thrown away. Before he receives his injury he must have been reduced to 60 or 70 per cent of his original 100 percentage of resistance by loss of sleep and loss of food. Therefore, if a man, we will just say, has been more or less severely wounded and has had no sleep, that, by itself, would reduce by just one-half the severity of the injury necessary to kill him, and it would take twice that injury to kill him if he had been fresh and well fed; one-half as much injury would produce as much shock here as twice that much would produce in a normal man.

Next type of man: This war has shown the most extraordinary things regarding emotion, the emotional factor that cuts people down. It is all right for us back here to say there is nothing in the emotional factor, but I have talked with all kinds of people who have been through the game, with soldiers and our own officers who have gone over the top with their troops, and I want to say that I have the most profound admiration for the way our men have done their duty. They have said, and I know myself, that the proposition of "going over tops" disturbs them. There is no question about what happens: The mechanism of the body is driven at enormous speed. I have talked with soldiers who have been over here three and a half years and with many that have become accustomed to the front line, and to look at them you would say they didn't mind. But they do mind, and they go over with the most intense feeling of anxiety, and with a rapidly beating heart; they live more life in five minutes than they do in an ordinary day, and you can compress in a short period of time an intense driving of the body organs that mean as much reduction to the factors of safety in five minutes as you would produce by four or five days' loss of sleep, or so much mental exertion. You have added to the man another factor by sending him over the top; for example, it is not at all uncommon to become demented in No Man's Land. Germans have come over to our lines not knowing where they were going in the excitement of battle; they shoot their own comrades, not knowing what they are doing.

Don't get the idea—I don't think you will, in plain justice—that men get used to the front line, get used to going over the top and don't mind it; there is nothing more fallacious, nothing more wrong. So when you think of shock, don't think of just a bullet wound; in that case the bullet may be the smallest part of the whole case. A man who has been kept awake a week at a time in the ditch, without sufficient food or drink, and is then subjected to the tremendous strain and anxiety of battle, may by that time have cut down his reserve and factor of safety to below 50 per cent, and yet he has not yet been touched; it may be as low as 40 per cent.

And then the battle starts and he goes into his last struggle for existence under great difficulties and with the most intense exhaustion; considering these facts you see what tremendous energy they draw upon to use up that last ounce of strength to fight for existence. When that time comes it is like putting a heavy load on an already overloaded machine. And so, in charging a long distance and taking an objective you can readily see that men will be tired out from the physical exhaustion itself, and still the man is not wounded. These things other than the wound are very important, however, and the most common causes of trouble. In the end, after that period of time and stress, suddenly the soldier is wounded. Several things will determine how much of a wound it requires to put that man out. Just remember that loss of sleep will do the same thing as the shell or bullet, and so will muscular exhaustion and emotion.

Finally comes the injury. The man gets a blow. Down he goes. At first there may be very little change in his condition. From the time he gets his blow let us consider the various things that may cause his death—after he gets his injury. His injury isn't the only cause. What I am trying to do is to have you see that there are so many things that are serious besides the injury which is oftentimes the least important factor in the whole case. The injury may consist of a little nick in an artery, but there are added these things we have spoken of. In such a man it doesn't take much to remove the last factor of safety and he may die from loss of blood. Yet if that hemorrhage is arrested and he is brought back with a light wound, is it strange that this man has had a tremendous amount of shock from this small injury? In reality, that injury has had only a little to do with the case. This man who had the hemorrhage didn't die from the traumatic injury, he died from a combination of things, and the hemorrhage finished it up.

A man comes in with a compound fracture of the leg or of the foot and his troops, his company, regiment, are being defeated. We always think of battles as being things we win; well, I expect we will always, but we are not always so sure of it. If he is injured in the leg or foot and he is retreating, what does he do? He goes along and drags that bone or hops along as fast as he can. I have found cases where men walked on a broken foot to get away from the enemy. Each time you step on a compound fracture you can see it get worse; the primary injury did little compared to what he is doing. These are more factors.

The next two factors are those in which we are vitally concerned. The first one of these is movement of the part. Suppose a man gets a fractured femur. Now we know that many deaths have occurred from compound fractures of the femur. In civil life if a patient has a compound fracture of the femur you wouldn't expect him to die of shock; out here they do. In one of the allied armies they had a great deal of shock and death in fractures of the extremities and the whole thing was changed by one thing they did, a perfectly plain thing to do. They carried the Thomas splint way out in the front area; this has been done with our troops. One of the best things that can be done for this injury is to put a Thomas splint over the fracture and handle him back to the rear in the Thomas splint. That was done and there is no better treatment for shock. In the early days—I was here in 1915, and that was not then done by the French—I, myself, have seen compound fractures handled long distances, in which the sharp bones have used up the muscle more than the missile, like a meat chopper, so that the stretcher bearers and those who handled him before he could be relieved did more harm than the enemy. If the methods of transport are good you need never lose these cases by shock from the trauma alone, provided a good splint is put on in the first place. Of course, if the man has only a small amount of resistance left you can knock that out going through the trenches, bumping into things; that will finish the man. Now, it is our duty, as I see it, to take every patient who has a compound fracture and to treat that fracture by extension, thus providing a certain amount of physiological rest at the earliest moment, and it should be kept up until the man reaches the hospital where that rest may be made as complete as possible. There should be no break in physiological rest from the time he is received from the stretcher bearers until he is discharged well.

Now, just right here I want to pause a minute to say a thing I didn't dream of in civil life—I didn't think of it at all, and that is, the enormous extent to which the whole problem of surgery in this war is an administrative one. I could go into that with a lot of detail. If an organization is created to treat shock you should start with the transport people; they

can treat shock better than the doctor. A quick evacuation to the rear means that the stretcher bearers have done what should be done, the men should be handled gently and carefully, and everything should be called on to prevent using up the slender percentage of safety to which we have alluded before. None of this has to do with the wound itself.

Cold.—As a matter of fact, in shock itself, cold is a big factor. I said some time ago at the beginning of this talk that in shock the individual has lost the power of creating heat in himself. You have to supply him with outside heat, a thing that will help to cure him. You see, he has been sweating, his body is moist and he is in a state of exhaustion; and the whole point anyway is that one wants to be sure to have those patients wrapped up very well. Of course we do pack him; we all do. We all know what to put over a man, put round his feet, but what you want to be sure to do is to put something underneath him as he lies on the stretcher. Did you ever lie on a stretcher on a cold day? Usually we think that the man is lying on a stretcher and the stretcher is warm. It isn't so at all; that thin canvas abstracts warmth from a man's body. The thing is to have blankets underneath as well as on top. I needn't go into the subject of warming on the stretchers, and so forth, because that's just a question of supplying heat. The hospitals are being equipped with warmers and all that sort of thing; I won't go into that at all.

We have now finished speaking of the temperature. Now, gentlemen, I don't want to lecture you about these things; but I would like to consider this more of a conference, and I would like to pause before going into the subject of treatment and if you wish to discuss the thing further I would like to do it.

Colonel ASHFORD. Major Crile, we had a very interesting shock conference at Bouleuse, which was visited by us in January, and we had a hundred competent French surgeons and scientists present. The general consensus of opinion tended toward the belief that emotional elements played a very important rôle in shock—

Major CRILE. Oh, yes.

Colonel ASHFORD. What is your position?

Major CRILE. I can tell you something about that. You can frighten the rabbit, and you can produce everything of this sort in a rabbit. Emotion is a most interesting thing. I have rabbits at home, that I have been able to kill by emotion alone. Lots of men are dying from emotion alone when they are not touched. Many of us may not believe it; we don't believe it is true. But if you ever talk to young medical officers—our own—who have gone over the top, they can tell you how real and true it is. In rabbits you can cause high fever or death from emotion as from anything else. If you have emotion you have acidosis, always. I have seen them with red blood cells in their urine. There is just now some research on that point in my laboratory. They put some rabbits in a ditch and fired a thousand shots over them, under much the same conditions as trench warfare. Then they increased the amount and the rabbits went down in exhaustion and died without being hit by anything; they were shocked to death by being frightened. We have always known that was possible ourselves; I think we all have had a "run in" some time or other; I think that sometimes a surgeon gets certain critical responsibilities and knows very well what that means.

Now, about giving a man a dose of morphia; let me tell you something interesting about that. I am going to draw a two-faced picture on the subject of morphia. If you give morphia at first you can't produce any emotion at all. The man who has had a big dose of morphia has neither fear, nor heat, nor cold, nor any emotion, nor with a big dose has he any muscular or mental power; it cuts this all out. You remember the time in the old days here in la belle France, when the aristocrats did not take kindly to being guillotined? Then some one hit upon the idea of giving them morphia first, and after that they did not mind it at all. On the other hand, take an animal that is in shock or emotion; you find their blood has lost its alkalinity and there is acidosis. Then, to my utter surprise, I found if you give these animals half a dose of morphia you can not restore their alkalinity and sometimes they die from acidosis alone.

I was going to make this point later, but I will make it now. Acidosis and shock are much the same thing or the whole thing; at least acidosis is a big factor in shock. Now the way that we overcome acidosis is by oxidizing the acid produced in the cells. What is emotion? It is a burning flame, in exhaustion you turn the flame up higher, but in emotion it

alone burns with great activity. Now morphia cuts down that oxidization altogether, and, therefore, if there is no emotion you get no acidosis, and if there is any acidosis you can not cut it off if you give large doses of morphia. Morphia interferes with the oxidization by means of which the thing is done, as when you have acidosis the only way you can cure it is by oxidization; morphia stops that. It is neutral; it deals with both sides alike. It doesn't allow the emotion to occur and it doesn't allow the cure when emotion has occurred. So up on the line we must be mighty careful in handling these cases. We must remember not to give a large dose of morphia to a man who is in a state of acute acidosis; this cuts off his power of oxidation. It is a very simple thing; be sure of this.

Colonel ASHFORD. I have also heard that Major Cannon, in the First Army, advised cutting down morphia, but that if it should be given there should also be given an intravenous transfusion of sodium bicarbonate or good alkaline drinks.

Major CRILE. Yes.

QUESTION BY A STUDENT. How much would you give, Major?

Major CRILE. That would depend. Now, for example—I will put it this way. If you have quiet trench fighting and a man is hit, it is pretty much like an accident in civil life. He was just living around in the trench and got hit unexpectedly. You can give him much more, but a quarter is all right there, and it may even be repeated. The point is: I would judge a dose of morphia by taking into account a number of circumstances. The first one is this: If you know that the man can not be evacuated without a tremendous amount of injury en route and things have been more or less quiet, go as far as you like with morphia; give a quarter of a grain and repeat that again. On the other hand, if that man has a wound that isn't likely to be very painful and if you know the road and it will be a quiet, easy trip back, then give only a very small dose of morphia. On the other hand, suppose a man came along with an abdominal wound. If it isn't a very slashing wound the best thing he can have is morphia. But if the man has been through all this hard picture I have drawn of battle—I don't know—not more than one-sixth of a grain at any rate. As far as I can see, the man who decides to give or withhold morphia takes a large responsibility. A lot of times a man gets opium and is saved; that is, if he didn't get it he would die. Opium has great effects on human organisms. I wouldn't for a minute say "Don't give opium," because it has done too much good to say that; nor would I be the one to say that you must always give it, because it may do harm.

Major BURNETT. What is your idea about giving alcohol before going over the top?

Major CRILE. I have discussed that thing and have thought of it a great deal and am unable to reach a conclusion. I have talked with the men themselves who have taken it and gone over the top—and I don't know. I understand the enemy uses ether, and according to all stories they certainly do come over sometimes in a very befuddled condition. There is no doubt at all that if a man stands in the trench all night, and knows the zero hour, and knows he is going over, and is chilled to the bone, I think a little rum might help warm him up. On the other hand, can't you see, a lot of men lose so much by being overanxious and over-excited and getting too much of the very thing we have talked about and this thing alcohol creates—I don't know. The armies which have been longest in the field get something alcoholic, but, on the other hand, these people over here have been accustomed to taking more alcohol than the average man in the United States does. The problem is so mixed up—I don't know.

I can tell you another thing that is perfectly amazing to me. I have spoken about how quickly the men may go down under this strain. Many go down with the most surprising resistance. Some fellows stay in shell holes for several days in No Man's Land. I know of one case up the line where two wounded men were out nine days under most extraordinary circumstances, and I would not have believed the story if I had not seen the men and the photographs verifying it. One of the men crawled out to forage in the night and took the rations off the dead. They spread out their raincoats and caught water; the Lord knows there is rain enough where they were. One of these men had a compound fracture of the femur, which united in the shell hole. Finally this man got well enough to crawl in. He had grown long whiskers in the meantime, long hair, and long nails. Compare this with the man who drops in shock before he even leaves the trench.

So there are high lights and shadows of extreme degree, and it is difficult to make rules. Captain Cowell made some very interesting observations: He took a crowd of men in the front area and found that they had a blood pressure 20 points higher than those in more protected places in the immediate rear. You see under firing conditions they are just stoking their engines all the time.

Now, gentlemen, let's go back to the treatment.

Do you know that the real restoration of a man in fatigue takes place only in sleep? Unless he gets sleep he does not restore what he has lost. In all our periods of sleep we have periods of fatigue and periods of restoration in the body, which explains what sleep does. If we knew the remedy which sleep produces we could cure all our cases of shock. We have tried to do it; everybody in the world has tried it; and yet sleep does it and does not try at all. That being the case, I mention it to give you the cue. If you can not imitate what sleep does, then give rest, physiological rest; give all the mental rest, all the physical rest, all the rest against pain, and every type of rest that you can; go as far as you can, and when your patient has pain give morphia to give him rest; there is no objection to it at all if there is no contraindication for it.

Next is warmth. It is highly important to give him warmth; that comes next to rest and, as a matter of fact, the two go together. Now these are two known facts.

And did you ever see a man go through a period of rapid respiration and prostration and notice he was thirsty? Nearly always they are thirsty. The man who has a fever is thirsty; the man who takes an anesthetic is thirsty; the man who has ordinary acidosis is thirsty; the man who is having a hemorrhage is thirsty; and everyone of these has rapid respiration. Thirst is a desire to get water to reduce acidity; that's all this is. Thirst and rapid respiration go hand in hand. Now it is always a good thing to take nature's leads; it is no mistake. You follow nature's lead in sleep and in giving rest. Follow nature's lead again and when men in shock are thirsty give them water. If you can't give water normally by the mouth in severe shock—and as a rule you can not in this war—give water by the rectum. If the rectum is overloaded with feces and you can't do that, give water subcutaneously. Then you have done a great deal.

Now even if all these measures do not fully relieve, would you give saline intravenously? I would say, as fast as you can put it into him if you are going to give it intravenously. But I think there is a better thing than that; I have worked on this problem a great deal at home in my laboratory and clinic. Many times we have given intravenously sodium bicarbonate in 5 per cent solution. It is better than salt solution, but it is not specific; this I was greatly surprised to learn. When we found acidosis we said, that's very simple; we will give sodium bicarbonate to cure him. But to my great disappointment it is not in the least specific, although useful. And perhaps you might think that if you gave it to an animal you could prevent shock altogether; but I have found we could still produce shock in them.

Now, the next question: Here I am venturing a little on uncertain ground. Professor Bayliss and his associates have done a lot of splendid work, and I am hoping that he and Major Yates will make something useful out of it. He has got the idea of taking a kind of solution that would not run out of the blood but would stay in. If it would stay in the circulation that would be the specific thing, and this he accomplished by the use of gum arabic solution, 5 per cent. Well, I tried that a good deal. It does hold up better than salt solution, better than sodium bicarbonate, but, unfortunately, I have had so many patients go and die just the same that I am not enthusiastic. It has not carried me over enough, but I wish it were true.

I think the best thing there is in addition to those we have mentioned heretofore is the direct transfusion of blood, because that is a measure that we know has been tried out a lifetime. It does the thing it is supposed to do and won't run out of the blood vessels. I have sent up a number of men from my unit resuscitation teams and they have done 325 transfusions of blood; they have had all sorts of other things as well, but there were 325 transfusions of blood alone. This is their conclusion: That it is a perfect specific, first, for hemorrhage, and, second, for a man who has had a little wound. But, as described earlier, the men with the small wounds show the greatest number of failures; the deeper the shock and the lighter the wound the more unfavorable is your prognosis—unless the man has a wound so big that his gross anatomical recovery is impossible.

Now morphia: Morphia is a first-class remedy provided you haven't acute acidosis. You may give it for pain in small doses, when the period of acute acidosis is over, when the man is no longer blue—never give a large dose of morphia to a man who is blue; never. We all know of many cases where a man was blue and we gave him morphia and we inducted him into his last sleep. I have done that. But I did that only a few times and then learned better. Have you ever given morphia with anesthesia? The man is blue; he is full of acidosis. Just by accident we discovered in my laboratory that in every case acidosis caused the blue color. I can tell you something about that. [Draws illustration on blackboard.] When you get over that line, that neutral line (a line representing 40 per cent of a man's resistance), death takes place immediately. You know how blue your patient gets—that's acidosis. Morphia comes along and of course does the wrong thing—doesn't it? It is just as plain as can be when you consider it in that light. So I say: Never give morphia in a case of over-anesthesia until the effects of the overanesthesia are past.

Now the anesthetic itself. I won't dwell much upon that, but I will say this. We have a lot of people who urge the use of local anesthetics, and there is this to be said about local anesthetics: If you have to operate on a femur and you can use local anesthesia so it will not reach the brain you get no shock at all; the operation is shock free. But if the blood pressure is low in an animal or man, when you give spinal anesthesia you have a fall of the blood pressure from the effect upon the nerves themselves and also you have a paralysis of all the muscles and that takes away the support of the blood vessels that lets it fall further. If you have any man using spinal anesthesia remember this fact. If, however, you have already a low blood pressure from shock, or from hemorrhage, and then you give spinal anesthesia that man goes right down and out; you should have a good margin of safety before giving spinal anesthesia. We published this several years ago. Give a transfusion of blood first, raise the blood pressure, and then you can give a spinal anesthetic.

But there have been a lot of slips in giving this spinal anesthesia. The British have found that nitrous oxide is best and they use it a great deal. In amputations of the thigh they have a high mortality rate, three deaths to a recovery; when they used nitrous oxide it turned right around the other way—three recoveries to a death. It reaches to the brain cells so they can't work; they haven't got the oxygen—it is turned off. The nitrous oxide leaves a little bit of light burning in the brain—that's all. Now if you give ether anesthetic, I must suggest several things that are important. One is that you watch the anesthetic for impurities, because it has been found that in manufacturing many impurities get in. So I say, look it over. I hope none of you give chloroform over here; I don't believe you will. Chloroform is a nice anesthetic to give and to take; and it is a nice way to get out of this world; but it should not be used in the rough and tumble work we have to do here. I think all experts agree on that.

I have already much exceeded my time, but I would like for a minute, if you wish, to have a discussion on any point you care to bring up.

(Discussion)

QUESTION. Have you ever heard of a case of a man being scared to death from shock?

Major CRILE. Yes; I think so. I believe there have been a few cases. It is pretty hard to say, but many people think there have been quite a number of deaths from that. You can hardly say a man was frightened and died without having something else; there might be the element of rupture of a blood vessel.

QUESTION. What do you think of the combination of chloroform, ethyl chloride, and ether?

Major CRILE. Personally, I am afraid of it, because you don't know what you are dealing with. The British are indorsing nitrous oxide as much as possible; but nobody ought to give nitrous oxide unless he has had careful training. I myself wouldn't for a minute undertake to give nitrous oxide to anybody; it needs technical training. As a matter of fact, the best anesthetists I have seen for nitrous oxide are those who have a very high sense of responsibility and are very keen and wideawake; a woman, as a rule, does very well. The very best anesthetist for nitrous oxide is a splendid woman, with a high sense of responsibility, on the verge of neurasthenia.

Army Sanitary School No. 110.

VISIT TO ADVANCED SURGICAL STATIONS, FIELD AMBULANCES, A MEDICAL CENTER FOR THE ARMY, AND A REST STATION, MAY 14, 1918

Left early in the morning for a trip to the Sixth Army to visit advanced surgical operating stations. The first one was at ———, which is about 10 km. from ———. This was a little town on a hill, in a most attractive wooded country, and the hospital was accommodated in a picturesque château at its highest point. We were met here by General Laznet, chief surgeon of the Sixth Army, who has the reputation of being a remarkably progressive man. He stated in a few words his idea of the advance surgical hospital, which was to the effect that it should be amalgamated with a first echelon hospital; that is to say, with the surgical ambulance of each division. That is what had been done here. All patients are sent to this ambulance for triage, which was underground and constructed of elephant iron; the advanced surgical hospital is in the rear of this, in the cellars of the château, and is entered by simply passing through the ambulance, which was well lighted with electricity. They only had 2½ m. of head protection and were at first only 3 km. from the front. This place was in an extremely exposed position. The only protection it had was its lack of visibility, because it was in the depths of a forest. As a matter of fact it has not been much hurt because the line has been successfully pushed forward by a famous advance of the French, which left it to-day about 7 or 8 km. from the front line. The ambulance had the usual receiving, bathing, and resuscitation rooms, and from there on the advance surgical hospital provided operating facilities and wards. The entire plant was seemingly perfect, whitewashed and painted, well equipped, and provided with attendants who were quick and well uniformed; there was an air of liveliness and thoroughness that was comparable only to what we had seen in Colonel Thoris's sector. The advance surgical hospital had a radiologic room, a small but very hot operating room with two tables, and a sterilization room next to this. There were 55 beds in wards on two floors, communicating by elevator. They had five neat female nurses on duty here, who are said to have accomplished splendid work. It is no exaggeration to say that, from the appearance of things and from the results that we saw they had gotten, few Paris hospitals have any better accommodations. They have a telephone, electric light, good heating, neat ornate wards, and absolute cleanliness and efficiency. It was a wonderful little operating unit, and the one surgeon on duty was the very best they could get. They keep abdominal cases 14 to 15 days. It was perfectly evident from the nearness to the front that the slightest reverse of the French would cause this place to fall bodily into the hands of the Germans.

We now proceeded by machine to ———, which was a G. B. D. triage, but had a field ambulance and also an advanced surgical hospital in connection with it. It was in a hilly country in the ——— region and the medical units were hidden in the ruins of the town, which was 7 km. from the front line. The town must have been very attractive before it was destroyed, but there is not a house now that has not been completely gutted. It is in full range of the German lines, but has hills and forests all around it and is itself down in a hollow. Owing to the severe shelling it still receives, the G. B. D. was underground, although there was a hut for the triage above ground, which is used when possible. The G. B. D. communicates, however, by a tunnel with the hospital, and the galleries were long and well lighted by electricity. It was at this place that an excellent demonstration was had of the way these hospitals were improvised. A village more in ruins could not be imagined, and still in the cellars of many a tumbled-down house was constructed a neat, clean, and even attractive place for wounded, which allowed careful and complete surgical care in the present-day sense. Every convenience had been provided, even an elevator leading down into the cave from the surface G. B. D. There were 15 beds, and some operating was going on when we arrived. It was perfectly safe against everything but a direct hit by a heavy shell.

At this point I was invited to accompany the director, M. Regaud, and the general's representative to what is perhaps one of the most advanced surgical stations in the allied armies—the quarry station of ———, known as Carriere R/1. In order to get to this place, which was distant about 10 km. we had to pass in full view of the German lines. The weather had cleared considerably and a German observation balloon kept the enemy advised of any passing vehicles. The only thing they allowed to pass without firing upon it was the hospital

ambulance. Only those of us who were traveling in a regular ambulance were permitted to visit it; the others of our party went by another road in the rear of the surgical ambulance to ———. Our road ran through the entire district over which the French had advanced, and from what was seen the fighting must have been terrific. Every house had been leveled and the forest destroyed.

When we reached our destination we were on a height overlooking the German position, on which was a stone quarry. At this point was a surgical ambulance, and working in conjunction with it the operating team of the advance surgical unit, the two being housed together. In this case no construction was necessary at all, the quarry furnishing all of the rooms. They had driven the Germans out of it; and, as it was previously used by them as a barrack, the French had a good deal of cleaning to do and a good many dead boches to get rid of. Near it was another enormous quarry capable of holding 20,000 men. This is the real solution for the underground operating plant, and yet these fellows were very unhappy underground. They stated that they get their patients back as soon as possible. It was lighted by electricity and well whitewashed, clean as a pin and equipped with everything that one could want in the good hospitals in large cities. The head cover was 6 to 8 m. This place evacuated for two and a half regiments and had 15 beds for nontransportable, although they could have had any number they wanted to. They had a septic operating room and dressing room apart from the others. It had been occupied by our American troops and they had left a number of large first-aid dressings there. In this place we found a dentist. The entire personnel lives underground in the station, but the kitchen is outside. As long as the line holds they can laugh at the shelling they get, which outside is by no means pleasant.

From here we motored down to a group of field hospitals at ———. This is a place on the heights overlooking ———. It had been occupied by the Germans—had formed a part of their advance line. From here to ———, about a kilometer and a half, they had shelled the city to their heart's content, and on every hand were evidences of their activity. The ambulance itself was practically safe at present (10 km. from the line) as the line had been pushed well away from it. It was in an excavated depression on a height and was neat and well equipped. This ambulance also had a portable surgical group here, and an extensive gas quarter, with elaborate preparations for mustard-gas cases. In the latter there was a ward for heating patients under hoods, a receiving room, a clothing room, etc. The clothing impregnated with mustard gas was not heated here because they had nothing to heat it with, so they dumped it into a tub filled with alkaline solution.

They bathed their patients with an alkaline solution and, after drying powdered them with bicarbonate of soda, magnesia, lime and oxide of zinc, 400 gm. of the first and 200 of each of the others.

This hospital is at present 8 to 10 km. from the line. There is a *groupe complementaire* here to operate on the nontransportable wounded. There was a good sterilizing room and on one side of it an operating room for septic cases. The gas quarter had two Bessonneau tents, with 20 beds each; one for convalescence and one to put men in immediately, which was darkened on account of the severe blepharospasm which this gas produces. There was also a good resuscitation ward. This hospital is specialized to receive the gassed and nontransportable wounded.

The kitchens in this place were in one building; one for the sick and the other for the personnel. Near by was a well of potable water and a washhouse. The pharmacy was rather large; and there was a vestuary for storing clothing, very well stocked. The officers lived in dugouts on the side of the hill.

We now visited a group of field ambulances of the corps. This was at ———. This hospital was extensive and undoubtedly could do a good deal of work. It was just across the stream from the city and here was the consulting surgeon of the corps. The operating rooms were kept pretty hot. This hospital was mainly in four Bessonneau hangars, the triage being accomplished in one of them. It was said to be a very hot hospital in the summer. The wounded were kept in two separate Bessonneau hangars. There are 250 beds for gassed cases and 250 for hospitalization of wounded. This is also an eye and ear depot and a hospital for the slightly sick and slightly wounded; it is now full. One of these hangars was filled with nontransportable.

From here we went into the environments of a town, to a château in the suburb of ———. This was a fine old château in an enormous well-wooded park, laid out with flowers, fountains, and watered by a stream. It also was very picturesque and was built in the seventeenth century. There is one ambulance installed here which is devoted to medical cases. It is a very important center, because here come the sick which are to be distributed to the interior, and here sits the medical board which decides on the degree of incapacity of all sick chronics of the Army. There is a triage for tuberculosis cases here, as before described for a similar medical center, with its radiologic outfit for diagnosis, its laboratory, etc. It came out in conversation that every army has a consulting physician who is also in charge of hygiene, and that our host was filling that rôle. The Sixth Army has six medical centers and they are all placed well in the rear. When a man falls sick in the line he goes to the infirmary of the corps, to the hospital of a division, or a H. O. E. One of the two ambulances of the division takes all the sick which can get well in 15 days. If it appears that they are to be sick longer they are sent to a H. O. E., and from there if they can not get well in four weeks they are sent here. Here, if he has acute trouble, he is kept and given from 10 days to 3 months to recuperate. If, however, his case is incurable within that time he is sent into the interior. If he is a chronic case and does not look as though he is going to get well, they send him before a board and the board recommends where he is to be sent in the interior. This army center can give 10 days' leave of absence. Every such hospital has an infirmary at which men can be treated that come from the troops cantoned in the vicinity.

VENEREAL AND CONTAGIOUS CASES

Really, these should be treated in the division, and normally they are, but there is provision made for a limited number of such cases here. They also may be treated in corps ambulances, or they may go to the special service hospitals created for that purpose alone. There is one such in the city, and it is bombarded constantly. The principle is to never send a man to the rear with venereal disease. There are no separate cutaneous disease centers. They all take venereal diseases, a questionable practice in our opinion.

TUBERCULOSIS CENTER

This is a big question. They are sent here under suspicion, let us say, with chronic bronchitis, and are examined carefully. It seems that the French Army in 1915 made up their minds to look up all the tubercular cases in the army. Since that cleaning-up time there have not been so many. At that time also when the diagnosis was made the place of origin was well disinfected.

NERVOUS CENTER

In this army there is no special neurologic center, but in this hospital there is a good neurologist. There is, however, a psychiatric center provided for, but these centers are only created when there is a large offensive. In the offensive of ——— they had at ——— 100 cases, of which three-fourths were returned to the lines in a week.

PHARMACY

This was the usual thing, plus a very unusual thing—a buffet where men were given hot drinks while they were waiting for prescriptions.

LABORATORY

This was small and devoted simply to clinical work. It is also mobile.

The inscription room for the triage of this center was small. Here there was a clean and attractive barber shop.

The American ward, donated by the American Red Cross, was well equipped, but the ventilation was poor as all windows were closed. There was an interesting feature in this ward which might bear imitation, in the shape of a clothes basket under each bed which could be locked with a Yale lock.

The recreation and reading room was perfect. It was cosy, artistically decorated, well furnished with small tables, each with pens and paper. There was a library also and the windows were curtained; men could be very comfortable here.

ARMY LABORATORY

At this medical center was the central laboratory of the army, divided into a bacteriological and a chemical section. There was also a sublaboratory for surgery. This laboratory was presided over by a very bright young fellow, and he explained that the object of the laboratory was not to examine everything which turned up, but to aid the local laboratories all over the army and do work which they were unable to do. It was very well equipped and fairly well installed; above all, there was a great deal of active work going on there.

The laboratory of hygiene and prophylaxis is a chemical one and, like every one of these chemical laboratories of the French Army, was absolutely clean and above reproach. Moreover, the kind of work that was going on was scientific, and the pharmacist in charge was thoroughly efficient and alive. They examine water, foods, poisons, and make certain chemical analyses coming up in medical and surgical cases. In these laboratories the water is examined both chemically and bacteriologically. If over a hundred colonies are developed in water it is condemned, and we were told that 30 per cent of the water examined had colon bacilli. There was a queer rule that was enunciated very clearly by the bacteriologist. He said if water has up to a hundred bacteria and is chemically good, it is considered potable; but if it only has 10 bacteria and is chemically unsatisfactory, it is condemned. They designate water sources by red, white, and blue signs—white for potable water, blue for water which is considered potable after treatment, and red for water not to be drunk under any circumstances. It is believed that far too much importance is given in the French Army to the chemical analysis of water, which is, however, excellently done. There was a good section for toxicology here. They were actually examining for poisons in tinned food referred to them by the American Army.

We now walked out over these extensive grounds, passed over a wooded ridge and, still within the same grounds, came upon the contagious diseases hospital, which is well separated from the main group of buildings. We had not much time there, but the impression it made was good. We saw two men in the receiving ward raving in the delirium of cerebral spinal meningitis. The cases in the hospital at the time of our visit were as follows: Mumps, 100 cases; cerebrospinal meningitis, 3 cases; German measles, 3 cases; pneumonia, 3 cases; typhoid and paratyphoid, 3 cases; scarlet fever, 15 cases; undiagnosed, probably the majority influenza, 40 cases. There were 26 convalescents and 250 beds, and the contagious diseases of 4 divisions were sent here. Gomenol spray was used in cerebrospinal meningitis, two or three times a day for 10 days. The hospital barracks are divided into segments for different diseases, but there is no special isolation against cross infection noted, but they probably got good results just the same. The sick officers are placed apart. Mumps is the worst infection they have. They have only seen one case of smallpox in three years in the whole army, and that was benign.

On the way home from this place we stopped at one of the most peculiar institutions that it has been our good fortune to see—a combination of trench mortar school and rest station. It was certainly an ideal rest station; loaded with flowers and surrounded by a peaceful farm country, with a fine view in every direction. The station was not a medical unit, but the Artillery officer in command was a practical hygienist and taught sanitation in addition to Artillery practice. He had a separate building devoted especially to cleaning up of men, provided with a barber shop, baths, and a good reading room. He was a warm personal friend of the chief surgeon and had not neglected to prove it. It was a good illustration of cooperation and of the value of having every line officer take sanitation to heart for the purpose not only of preventing disease but of making his men self-respecting and comfortable. We saw one thing there that was really worth while—a real club for officers. It was a well-painted, well-furnished, and well-supplied lounge in a little old-fashioned village house. Near it was a fine post exchange, which was not unlike a large grocery store. It had sold fine wines and all kinds of canned goods, tobacco, etc. In addition a handsome tea house was provided where we were served by some English nurses with chocolate, etc.

Army Sanitary School No. 111.

SECONDARY AND LATE COMPLICATIONS OF BRAIN WOUNDS

By Medecin-Major George Guilan

SUMMARY

Important subject of pathology from the point of view of the neurologist, the general surgeon, and the sociologist.

Our study and conclusions are based on personal documents and information received from all the French neurological centers, crystalizing in a report read before the Interallied Conference of November, 1917. This information covers 6,664 cases.

Subjective symptoms in trephined patients are: Headache, vertigo, psychic disturbances.

General neurological examination and its findings, pathogenesis and treatment of these disorders.

Organic lesions following injury of the brain.

The future of injuries of prefrontal lobes, the Rolandic zone, the pyramidal tract, the parietal lobe, the occipital lobe, and the thalamus.

The grave mental disorders; their scarcity.

The late epileptic attacks, the future of these cases, their treatment.

The late abscesses of the brain; clinical study, diagnosis, and therapeutics.

The late meningitis.

Brain hernia.

Foreign bodies in the brain; what to do.

Cranioplasty; its indications and contraindications.

General remote death rate of trephined cases.

Aptitude of these cases for military duty and work in general.

Conclusions.

His experience comes from a careful examination of 6,664 cases of old injuries involving the brain.

Subjective troubles of old brain injuries.—(1) Headache, worst at the point of lesion. It is like migraine with vomiting and is aggravated by lowering of the head.

(2) Sudden attacks of unconsciousness, lasting a minute or so.

(3) Vertigo, as in Meniere's disease.

(4) Psychic troubles, amnesia, etc.

(5) Asthenia, difficulty in working, in arriving at a decision, etc.; inability to endure emotion, irritability.

Objective signs.—(1) Eye changes—choked disc; changes in the size of the pupils.

(2) Changes in the reflexes—reflexes liable to be exaggerated, including the cutaneous.

(3) Changes due to injury or affection of the semicircular canal, giving uncertain gait, etc.

(4) Babinski's sign.

(5) Thermic instability, with variation in bodily temperature of $1\frac{1}{2}^{\circ}$ C. a day.

(6) Changes in the spinal fluid, increase in albumin content (hyperalbumin and cellular changes).

(7) Neurasthenia. It is possible that some of these cases are merely those of neurasthenia, but it is a fact that old cases after brain operations are mentally inferior to what they once were; they are "diminués."

There is far too much trephining in this war and exploring of brains, and the bad results are seen in these old cases. Such old cases are very apt to be emotionally unstable. Slight causes provoke rage or fear. In fact an old case of brain injury is liable to have neurasthenia. They may even be ataxic.

The labyrinthine troubles account for the vertigo of old brain cases, and such people can not stand looking at a cinematograph show. Later there is a lack of equilibrium and coordination. One of the best tests for this is Babinski's biauricular test. That brings out these lesions well. The chronic headache of very old brain injuries may be due to increased pressure in the cerebrospinal fluid, and we may relieve this by a lumbar puncture once a month. Old brain cases are liable to have flashes of light in the eyes, loss of memory

of recent events, and especially of events connected with the accident. In very rare cases you may have abolition of the deep reflexes, but generally the reflexes are exaggerated. Pupillary congestion of the eye occurs sometimes. The temperature is apt to rise abnormally after exercise.

The moral of all this is: Do not take away so much bone when you operate on the brain; use small trephines and use them less.

The first, second, and third frontal convolutions can be badly involved without sequelæ. The Rolandic convolutions if they are injured give typical reactions. The parietal ascending convolutions of the Rolandic area affect the sensibility as well; that is to say, deep sensibility, the judgment of shape and position in space, the astereognomic sense. The prognosis of injuries to the Rolandic area is at first seemingly very bad because there is absolute paralysis, but usually in a few months the patients can walk and perform other ordinary acts. It is not well, however, to promise anything until a year is elapsed. Focal epilepsy is not always due to injuries of the Rolandic area.

Injuries of the supramarginal convolutions cause anaphasia of the type Wernicke. This is a serious form of injury and brings about a lowered mentality. It is much better for the patient to have a monoplegia. The injuries of the first parietal yield no symptoms and the same can be said of the second and third temporal. But injuries to the posterior portion of the first temporal convolutions cause sensory aphasia. Hearing is not injured by lesion of the temporal lobes. Injuries to the superficial portion of the occipital lobe gives no symptoms, but injuries to the deeper portion give hemiopia and other eye affections, which, however, tend to rapidly disappear. Old injuries to the occipital lobe, internal surface around the calcarine fissure, cause scotoma of which the patient is often ignorant until examined by an oculist. Lesions to the internal capsule from the knee to the posterior limit cause permanent massive, hemiplegia, a permanent spastic paraplegia; never partial. Injuries to the optic thalamus cause thermo-tactile anesthesia, and disturbance of deep sensibility. When one has a painful anesthesia you can assure him that he has an injury of the thalamus.

In general the late effects of the wounds of the brain are by no means as serious as one would expect. Of the 6,664 cases only 10 per cent, or 675, were epileptic, and many of them only partially so. Jacksonian epilepsy points to some local cause of irritation, but some cases developed epilepsy two years after their injury. We should operate in Jacksonian epilepsy only after repeated localized attacks. Trephining for adhesions supposed to be the cause of epilepsy of war wounds is very fallacious and dangerous owing to the fact that there has been penetration and that there is a long cicatricial tract; you never know what part of the tract is causing the irritation which sets up the epilepsy. Besides, apparent Jacksonian epilepsy may turn out to be something else. For instance, it may be the beginning of a brain abscess which is initiated by symptoms like true "mal de epilepsie" with short periods of unconsciousness; these attacks become more frequent one day become generalized, reaching to as many as 40 attacks in a single day. Now a fever of 43 is noted and there is a hyperalbumin and a leucocytosis of the spinal fluid. The answer to all of these is abscess of the brain and not Jacksonian epilepsy.

There is another possibility which complicates the diagnosis: Cases of localized, non-suppurating encephalitis, which one might think were going to turn out to be abscess of the brain. There is also an epilepsy due to hypertension of the cerebral fluid, and this is relieved by lumbar puncture.

The cause of obscure delayed brain trouble may be due to thickening of the dura and adhesions around vessels which cause a diminution in the blood supply.

Acute encephalitis causes a slow and irregular pulse. If it is localized it can be treated by chloride of calcium, $\frac{1}{2}$ to 1 gm. a day, and bromides. A diffuse encephalitis is always fatal.

No cases of general paresis have been observed as having been due to war wounds. Only 47 cases of injuries to the skull of the 6,664 studied have presented insanity of a severe type.

Of 4,262 cases, there were collected 710 hemiplegias, 206 monoplegias, 200 asphasias. Quillain has collected 164 cases in which foreign bodies were lodged and very few gave any trouble. They should not be fooled with unless they cause symptoms. The truth is that fragments of cloth and splinters of bone cause more after-trouble than the projectile.

Delayed abscess.—Of the entire series, there were only 94 cases of delayed or late abscess. These began with headache, vomiting, and bradycardia. You should always send for an ophthalmologist in the presence of these symptoms to examine the fundus of the eye. Whenever in a hemiplegic, due to a war wound, this hemiplegia is exaggerated, look out for abscess in the presence of the above signs. The diagnosis between acute encephalitis and abscess is difficult. The local symptoms are more exaggerated, however, both with irregular and slow pulse. Gordon Holmes says that late abscess of the brain occurs in from $1\frac{1}{2}$ to 2 per cent of all cases. The treatment is to open the abscess, and a bacteriological culture should be always made of the pus at the time and successively thereafter in order to know when to close.

Retarded meningitis.—There are only 32 cases in this series. In this case one should operate if the epilepsy is Jacksonian, but if the epilepsy is general there is no treatment possible.

Cerebral hernia.—This may be due to a deep abscess, and in such case you should not do a lumbar puncture, as pus may be thus drawn into the lateral ventricles or spinal canal and set up meningitis. It is a rare condition and is generally due to deep infection. The treatment, of course, is to open the abscess well. When it comes on late it has the same significance. You need not hesitate at all to cut off the fungoid growth, as the nerve cells therein have long since disappeared.

Cranioplasty.—Many cranioplasties have been done, but correct records of the results are difficult to get. Marie studied 21 cases, with the following results: 6 improved, 12 remained the same, 3 were made worse.

Statistics.—Of 4,983 cases which recovered, 1,267 were permanently discharged from the service, 1,559 were temporarily discharged, 1,802 were made noncombatants, and only 295 returned to the trenches.

By cranioplasty we mean a bone graft or the placing of cartilage or fluids to fill in the defect in the skull. There is a double object in view: First, an esthetic one in which the result is attained; and, second, a curative one for the subjective symptoms, but the results are not good. If the wound is large the plates are not well tolerated, and in small defects they are not needed. You should never do a cranioplasty unless the nervous system is intact, and you should never send a trephined man back to the front, under any circumstances.

Army Sanitary School No. 112.

WOUNDS OF THE ABDOMEN

(Summary of a lecture by M. le Medecin-Major Okinczye)

I. Definition.—Only penetrating wounds will be considered under this heading.

Their gravity is due essentially to the injuries of the viscera, the gravest being the intestinal wounds; then in order those of the liver, the spleen, the bladder, the kidney, and the stomach, and the blood vessels—vena porta and blood vessels of the intestine.

Graver still are associated injuries—pleuro-visceral, thoraco-abdominal, spine, skull.

Necessity of preliminary examination to decide whether to operate or refrain.

II. Indications for operation and contraindications.—The operation is serious, long and difficult—presupposes, therefore, sufficient resistance on the part of the patient.

(a) Immediate and absolute contraindications: Absence of radial pulse—low blood pressure—traumatic shock—association of irremediable injuries.

(b) Relative contraindications: Thoraco-abdominal injuries, grave associated lesions of the limb or skull and time elapsed since injury.

(c) Indications: Signs of active intra-abdominal hemorrhage. Radial pulse below 120.

III. Examination of the patient.—Conditions under which examination is made. Diagnosis of penetration; signs making the diagnosis probable or certain; situation of the wound; muscular defense; percussion; urine; vomiting; digital examination of the rectum; radio-scopy, for finding and locating projectile.

IV. Preparatory treatment.—Treatment of shock—heat, morphine, etc. Duration of this treatment.

V. Operative treatment.—(a) Choice of anesthetic—chloroform, ether, morphine.

(b) Choice of incision.

(c) Exploration—explore before repairing; explore before manipulating. Exploration must be anatomical and methodical. Exteriorization of injuries—simple for the small intestine. Splitting of the fascia to make this possible for the duodenum and large intestine. Particular positions of the patient necessary for the upper and lower abdomen.

(d) Repair of injuries—freshening, suture, and resection of the intestine. Treatment of injuries of liver, spleen, and kidney wounds.

(e) Cleansing of the peritoneal cavity—ether; artificial serum.

(f) Drainage—must one drain? How to drain.

VI. *Postoperative treatment.*—Diet; Fowler's position; Murphy drip.

VII. *Study of a few cases and results.*—The diagnosis of the penetration is made by the appearance of the patient plus the usual signs. Do a laparotomy and examine the intestine, the liver, the spleen, the bladder, the kidney, and the stomach in this order, which is the order of seriousness of the injury. There is a great deal of shock in abdominal cases, and a fall in temperature makes the prognosis much worse in winter than in summer. Wounds of the kidney and stomach seem to be less serious than those of other organs. Of 64 cases seen lately 40 were operated upon, 20 recovered, 20 died, 2 more were benign and had no operation, and the rest were not operated upon on account of the gravity of the case due to shock, and all of these patients died. Operation to be successful in this class of cases needs to be early. In periods of calm the abdomen should be opened as a routine whenever the indication is clear that there has been an injury within and the state of the case permits, but all cases should not be operated upon, of course. The condition of the pulse is the most important indication. As long as that is below 120 one can feel safe in operating. If the wound is a thoraco-abdominal one, operate on the abdomen first, and if the condition of the patient forces you to stop, complete the abdominal operation and repair the thoracic injury later. After 12 hours from the receipt of the injury the chances are not good. Hemorrhage is an indication for immediate operation. Complete absence of radial pulse is a contra-indication to operation. Cases are especially bad that have serious multiple wounds in addition to those of the abdomen. It is a very suspicious sign when you have all the symptoms of shock plus a great deal of pain in the abdomen; colic in shock stands out in intra-abdominal injuries. In badly shocked cases always transfuse your patient before the operation. This is especially so when shock is accompanied by hemorrhage, in which you should operate as long as you can feel the pulse. You can not give more than three-quarters of an hour or an hour to treatment for the relief of shock in abdominal wounds. Then if you are going to operate at all, operate without further delay. Small wounds of the flank, groins, and buttocks are apt to end in intraabdominal injuries, and they should be carefully examined and watched. You should catheterize to avoid overlooking bladder injuries and also make a digital examination of the rectum. It is not safe to continue preparatory treatment of any sort longer than the time we would give to combat shock. Morphine is of great value in this treatment. You may use either chloroform or ether, but ether is preferred. Never use lumbar anesthesia. It should be a dictum that abdominal wounds should have precedence over all others if they are at all serious, as they usually are. In fact, wherever there is any doubt open the abdomen, and such doubt will come in connection with wounds of the lumbar region, wounds of the lower thorax, and wounds in the flanks and buttocks before mentioned. Examination should take place in a warm room, but accurate diagnoses are best made after opening the abdomen. He emphasizes the fact that injuries of the intestinal blood vessels are very dangerous, and that when you operate under these conditions transfusion should be going on at the same time. It is useless to operate on a man who has an injury of the spinal cord. The diagnosis should embrace, always, a careful X-ray examination. The great point is to distinguish between the small wounds and the severe ones. There is no injury of the abdominal contents without rigidity of the abdominal muscles, and it is a most important sign of intraabdominal injury. Fear plays a great part in producing shock in abdominal wounds, and the wounded man should be removed from the front as soon as possible, but it should be borne in mind that rough and cold ambulances are the cause of many deaths in abdominal wounds. Their gravity depends upon their extent and their number. In intraabdominal injury a suspicious sign is the disproportion between the size of the wound and the serious condition of the patient. This is peculiarly suspicious in wounds of the buttocks with an abdominal syndrome where

one would not expect ordinarily to find intraabdominal injury. In operating on these cases we should give a good incision for exploration; that incision should be anatomical and preserve the muscular wall. It is very important to have proper retraction to allow a careful visual inspection before the hands go into the abdomen. Always explore in this way and with the hands before you operate, but in so doing do not eviscerate. Make a routine examination from the stomach downward, through small intestine and colon; use hot compresses. The Trendelenburg position is useful in making a thorough examination of the pelvis. In repairing, freshening, and suturing, if the mesentery is injured, do a resection of the part affected together with removal of the injured mesentery. An end-to-end anastomosis should be done, as it takes less time. If the spleen is more or less severely injured, better remove it than try to sew up a large wound in it, but the kidney should not be removed unless there is a vascular injury. Do not use ether inside the abdomen, but salt solution at 40° C. In going over the intestine you can explore the ascending, the transverse, and the descending colon well, but the flexures are hard to get at. A very good plan in this case is to reach up and free the ligaments holding the flexures to expose them. This can be done, especially on the left side, where the ligament runs from the spleen. As soon as the injured part is found, pull it out and clamp it and go on. With regard to the intestine, small wounds can be sutured or elbows can be formed. Before closing the abdomen go over every part of the intestine with a sponge. A particularly serious combination is a combined wound of the intestine and of the liver. Regarding the after treatment, unless there is an injury to the rectum, the sigmoid, or the descending colon, use the Fowler position or the Murphy drip. Keep on starvation diet for 24 hours. Do not give a laxative for a week. Remember that glass tubes only drain the pouch of Douglas. Remember that the cases that you get within 3½ to 5 hours after the injury have the best prognosis. Consequently, if you can not bring them back within that time to a regular hospital, send up a team to meet the man and operate on him at a field hospital, because it is better to bring the operation to the man than the man to the operation in this case. But if you have good transportation for wounds of the abdomen, send the man back; do not leave him at the ambulance head. In fact, he believes that good roads and good ambulances are the real solution of the problem and time hasn't quite as much to do with it as we used to think. These patients do not die from peritonitis but from shock, hemorrhage, etc.

Army Sanitary School No. 113.

GUNSHOT WOUNDS OF THE SKULL—THEIR IMMEDIATE TREATMENT

By Medecin-Major Lecene

TRANSLATION OF SUMMARY

The gunshot wounds of the skull (including wounds caused by bullets, shrapnel, and shell splinters) are certainly among the most severe and deadly observed in this war; many of such wounded die in the first few minutes or hours following the injury and remain on the battle field. A second important percentage of mortality occurs among those who are transported to the field hospitals and who are hopelessly wounded (bursting fractures of the skull); these can not be operated upon.

The remaining (about a third) are the only ones of interest for surgical treatment.

It must be emphasized that since the use of the helmet has become a matter of regulation, the gravity of the wounds of the skull is very much lessened. The helmet is chiefly useful for preventing the penetration of shell splinters or shrapnel and the introduction into the wound of dirty fragments of the cap, so often observed at the beginning of the war. The helmet is not so efficacious against bullets. The wounds of the skull are doubly dangerous: (1) Because they injure the bones of the skull (danger of osteitis); (2) because they injure the meninges and the encephalon (encephalo-meningitis), without speaking of the numerous late complications and definitive lesions of the brain (hemiplegia, hemanopsia, aphasia, traumatic epilepsy.)

The skull wound can be separated into two great classes: (1) Nonpenetrating or extradural wounds; (2) penetrating or intradural wounds.

The first class of wounds is certainly more benign; but it must not be forgotten that an extradural wound can be complicated: (1) By osteomyelitis of the bones of the skull; (2) by severe contusion of the brain, even though the dura may be intact.

The special severity of gunshot wounds consists usually: (1) In the more or less contusion of the parts by the missile; (2) in the penetration and implantation in the wound of septic foreign bodies. (The hair of the soldiers must be always cut very short.)

There is a class of penetrating wounds of the skull that is especially dangerous, namely, the wounds penetrating into the brain cavity after passing through the accessory nasal cavities (ethmoid, frontal sinuses).

Wounds of the skull can be anatomically divided into several varieties: (1) The tangential extradural wounds; (2) the tangential intradural wounds; (3) the perforating through and through; (4) the depressed extradural fractures; (5) the depressed penetrating fractures.

The first and fourth varieties are quite analogous to the fractures observed in civil practice.

The second, third, and fifth varieties are certainly more severe than the revolver bullet wounds observed in civil practice, because the war missiles are much more destructive and irregular.

The importance of microtraumatism disseminated in the white substance of the brain must be here emphasized (small foci of localization observed at a long distance from the principal traumatic focus).

The greatest immediate danger for the patient is, naturally, the infection of the meninges and brain tissues. It is evident that another great factor in skull wounds is the damaging of various parts of the encephalon, but it is not possible to treat here this important question.

The primary shock is generally not very severe, according to my observations. The pulse is generally full and the wounded, often unconscious, do not present the dangerous shock of many wounded in the extremities.

I think it is justly the unconsciousness of the wounded which explains the absence of "mental" shock. A practically important consequence of this observation is that the cerebral cases can be transported to a relatively distant hospital without aggravating.

To prevent the infection of the wound must be the principal scope of the military surgeon; the reparation of the possible damage caused to the encephalon by the missile is entirely the work of nature, after infection is done away with.

It must be remembered that wounds of the skull are generally less soiled than wounds of the limbs (helmet; nonpenetration of fragments of clothes).

A very difficult question is that of the missile or bone splinters deeply included in the brain substance. Some surgeons think that every wounded man whose brain has a missile or bone splinter in it is condemned to death sooner or later (delayed abscess of the brain), sometimes one year after the injury. Consequently every missile lodged in the brain must be removed. But it is not at all certain that the remote prognosis of the lodged missile is so irremediable severe; numerous cases of tolerance of missiles by the brain are now known, and certainly the number of those cases will increase if the immediate suturing of the skull wound is more generally practiced. Often the secondary complications take their origin in an osteitis following the "leave open" treatment of the wound. I think that it is chiefly a matter of each individual case. When the missile is not too deeply situated it is certain that it must always be removed, and the sooner the better. But, when the missile is small and deep, I think that the removal of this foreign body is often more dangerous than abstention. The operation, even when it is done several weeks or months after the injury, is always difficult and very damaging for the brain substance. When indicated, this operation should be done only after a careful localization of the missile with special instruments (Hirtz's compass and under the direct control of X rays).

The most frequent immediate complications of the skull wounds are: (1) Diffuse encephalo-meningitis; (2) localized meningitis with superficial brain abscess; (3) deep brain abscess; (4) cerebral hernia.

The surgical treatment of the first is practically nil. The localized meningitis with cortical abscess can be cured by opening and draining. The deep brain abscess is very severe,

and its diagnosis is always difficult. It is rarely multiple and its opening into the ventricles is frequent and always ends fatally. When this deep abscess is solitary and duly recognized, it can be cured by opening and draining like the otitic brain abscess.

Cerebral hernia of moderate size, appearing soon after the injury and chiefly when the wound is left open (a bad method), is generally due to the edema of the brain around the traumatic focus; it can be easily cured by enlarging the opening of the bone perforation and by gentle pressure, as also by lumbar puncture. But cerebral hernia, generally of great size and appearing later, is much more severe. It is generally then produced by a form of suppurating encephalitis beneath the trephine opening. It can be cured only by the opening and draining of this focus; but generally the encephalitis is diffuse, the pus not collected, and the majority of cases end fatally.

All these complications can be generally avoided by the following treatment, which is only a particular application of the general treatment of fresh wounds:

First. Excision of the wound.

Second. Enlarging the opening caused by the missile.

Third. Careful removing of the bone splinters, foreign bodies, and missile (when possible and after X-ray localization).

Fourth. Suturing of the wound with a safety drainage, remaining two days. Naturally this treatment must be applied soon after the injury (on the first day).

With the systematic use of this method for eight months I was able to lower the mortality of penetrating wounds of the skull to 17 per cent from 60 per cent, the death rate observed by me in the first months of the war with the "leave open" treatment.

This lecture was confined to the pathology and treatment of gunshot wounds of the skull. This is the most serious of all war wounds and was the most common cause of death on the battle field in the Russo-Japanese War. All cases are not of particular interest to the operating surgeon; they live to get to the field hospital and that is all; probably two-thirds of men with skull wounds die on the battle field and in the field hospitals.

If the skull is well treated the brain often escapes injury. Extradural wounds are much less fatal, as the dura is quite a barrier to infection; hence you should not open it unless you have to. It should be remembered, however, that severe contusions of the brain occur from a wound not opening the dura; there may be even no fracture to show for it. Of 26 such cases, 3 died. We should remember, also, that tiny pieces of shell with sharp, cutting edges produce effects such as experimental physiologists might produce with a bistoury, giving extremely localized effects. The cavity is usually reached by injuries of the vault. The steel helmet is a protection to the head, but it should not be forgotten that it frequently deforms bullets and causes, therefore, worse injuries when they do penetrate. He believes that men going into battle should have their heads shaved on account of the blowing in of the hair and infection of the brain.

He divides wounds of the skull into five varieties:

First, gutter fractures with the dura intact, although the underlying brain may be badly contused, as above noted.

Second, tangential fractures, where the cranial cavity is infected and the projectile emerges by a larger exit than that of entrance.

Third, perforating wounds of the brain, the most dangerous of all.

Fourth, explosive wounds, which invariably wind up in the cemetery.

What one generally sees as the result of a shell injury is a rough fracture of the skull, as if from a hammer, the depression or craterlike funnel formed of four fragments pressed in. Often a bit of a bomb is lodged in the skull; it sometimes goes no farther than the external table, but on opening we find a piece of the internal table fractured, with extradural hemorrhage.

In another type splinters of bone, with hair and bits of scalp, are blown in, forming a chamber of attrition surrounded by brain tissue, punctuated with petechial hemorrhages. Such hemorrhages may affect a whole hemisphere.

Brain cases are proverbially believed to be in a state of shock, but unless the anatomical injury is going to be fatal they are not. They lie as if in an epileptic coma and not in collapse. They are the antithesis of chest wounds and can be transported from 18 to 30 km. without

damage. As a matter of fact this long transportation is necessary, for they need a good hospital, free from noise and dirt, where they can remain in good hands until they are well.

The treatment.—Prevent infection and complications. This is done by excision of the contaminated, dead, and devitalized tissue. Reparation and return to physiologic condition is in the hands of nature alone. The surgery of the brain in war means very little intervention. For an extradural fracture excise your devitalized tissue, remove foreign material and the missile, if it is near the surface, and close with a filiform drain. In treating wounds involving the brain, suture the skin but do not touch the brain substances. Lecene does not believe in decompression operations. As to lodged projectiles, these do not all cause trouble, but they frequently do cause abscess. Pieces can be removed from the brain substance if they are only 5 to 6 cm. away, but no farther, especially if the missile is rather large. Lecene is bitterly opposed to removing projectiles after the wound is healed. He states that we should evacuate an abscess always.

Meningo-encephalitis is not seen when the excision of the scalp wound is properly done, and as a matter of fact the primary suture has done an enormous amount already in reducing the mortality and the after effects of war wounds of the skull. Local abscesses are easy to treat, but they are easier to prevent by excision of devitalized tissue in primary suture. When a missile or foreign body lodges deep it may set up a localized abscess where it lies, but this is rare compared to what usually happens, which is that the tract of devitalized tissue breaks down from the wound of entrance progressively on to the place where the missile is lodged, and this may extend sidewise as well as directly in.

Traumatic hernia.—First, immediately following the wound. This looks like a mushroom, and the cause is hypertension of the brain and edema of brain tissue. It is generally easy to cure by enlarging the opening and by applying pressure.

Second, late. These hernias appear two weeks after healing of the wound, and are large. They are due to encephalitis and abscess, and the prognosis is extremely grave on account of the cause.

The usual treatment of skull and brain wounds.—First, excision of the wound of entrance. Remove bone and splinters, foreign material, and devitalized tissue as far as possible.

Second, close the wound, as the bacteriology of these wounds shows the cerebral mass to be usually free from infection.

From November, 1914, to June, 1915, he was in the habit of seeing the wounded of the skull and brain from 12 to 48 hours after their wounds were received, usually 24 to 36 hours after, and at that time 12 out of 15 died. This was in a field hospital, and was poor on account of the hospital itself. His last results, with ideal conditions, were 20 out of 24 penetrating wounds cured. He had 26 extradural wounds. Although these lives were saved, he can not speak much of their future as to function.

At the conclusion of this lecture the director of the school, Professor Regaud, protested bitterly against considering these cases intransportable and against keeping them at the front.

Army Sanitary School No. 114.

GUNSHOT WOUNDS OF THE NERVES AND THEIR SURGICAL TREATMENT

By Medecin-Major Lecene

TRANSLATION OF A SUMMARY

The tiny pieces of shell, irregular and sharp as a razor, cut or nip the nerve in this war much more frequently than in previous wars, although complete sections are rather rare. In addition there is a radiant action on the nerves, a molecular stunning not seen in civil life. Lastly, to this must be added infection.

Lecene saw a hugely swollen end of a sectioned nerve (the sciatic) in which a fragment of projectile in its course had buried a bit of periosteum and which "took" as a graft producing ossification of the bulbous end.

In type 4 Form A (referred to in summary below), the axis cylinders pass on either side of the neuroma; in Form B, there is an external neuroma but still within the sheath. These neuromata he calls pseudoneuromata of attrition.

The bulbous ends of a severed nerve the French say are really "keloids," but we would call them formation scar tissue.

In type 1, as a matter of fact, the frayed-out end of the proximal piece of nerve is soon embedded in connective tissue cells. Although the axis cylinder pushes out vinelike shoots into this mass in its vain endeavor to reconstruct the bridge over the gap caused by the missile, these are caught in this scar tissue and crushed to death. Therefore we have to cut off the bulb well back in order to get healthy axis cylinder.

In type 5, the same thing occurs for the part of the nerve affected. In type 4 the neuromata can be enucleated. A diffuse neuroma (type 5) has a variable amount of nerve tissue ensnared and crushed in the neuromatous growth.

If we admit that these so-called "keloids" are impassable, then we should extirpate them, but in certain cases the function is nevertheless reestablished, and right here lies the bone of contention; the surgeons arguing for operation before it is too late and the neurologists arguing for more time to demonstrate the necessity for the operation in the hope that function may be established without it. When there is loss of sensation and motion, loss of muscular sense, trophic changes with reaction of degeneration, and a failure to excite the nerve by the faradic current, or even the galvanic, the evidence seems complete that the nerve is really interrupted. But in other cases, with the syndrome of compression, the decision is difficult. One should not rely too much upon the electric reaction of the nerve, and it should never be depended upon solely. There is a certain conservation of sense of pain on deep pressure in badly compressed nerves which allows one to say, in spite of other discouraging signs, that the nerve is not interrupted. One thing is certain: One should not wait too long to do a secondary operation upon the nerve, as the distal part degenerates entirely.

Owing to the cutting, laceration, and shocking caused by high-explosive shell wounds, lesions of nerves are extraordinarily common now. Lecene believes that with the primary or primary retarded suture there will be much fewer cases of serious and permanent nerve trouble. The neuromata are a source of pain as well as loss and damage of function. Really, the best way to find out about the actual condition of a nerve is to cut down upon it; and if it does not respond to the faradic current, operate.

The most frequent types of nerve injury are seen in types 2 and 5.

The syndrome of irritation of a nerve.—This is a surgical neuritis, follows infection, and is apt to be superadded to a lesion of adjacent vessels. In a case of this kind we get burning (causalgia), dryness, and violent paroxysmal pain. The patient is anxious all the time because he never knows when he is going to get a sharp attack. This pain is indescribably acute. The sufferer from an irritated nerve must always have cold water near by so that if pain and causalgia come on he can plunge the part into it. To these symptoms may be added trophic and sympathetic troubles, generally at the level of the hand or the foot. There may be contractures, cyanosis, anesthesia, hyperesthesia, etc. After all, what interests us is, What shall be done? The causalgia is on our hands and those cases are a terrible responsibility to the surgeon. The question must be answered, Shall we resect, or what?

The prevention in a fresh wound of the type shown in types 1 and 3 is apparently only a simple primary or primary retarded suture. But in types 2, 4, and 5, what are you going to do there surgically with primary suture? In addition to this, you should not rely too much on primary union in a case like those illustrated by types 1 and 3, because the ends are badly shocked and you do not know how far up. Those widespread contusions of the nerve may later end in diffuse neuromata and even if the nerve may not be cut, a block may be constituted by the fibrous tissue which forms between the healthy proximal and distal portions. An exploratory operation is not of itself dangerous, and one can thus decide many important points.

The treatment of the type 1 wounds is clear in a secondary operation—suture. The only difficulty lies in deciding how much of the ends are involved in the keloid process at

the ends of the healthy portions. When there is a considerable interval after all is cut away that should be, to join healthy ends you can not bring them together and make them unite by putting the extremity into all sorts of positions to secure approximation without tension. If you do this you will have ankylosis in a bad position. You should certainly not attempt to bridge over a gap in the way described by so many textbooks of turning down a flap of nerve from above. The best thing to do is to decide on a graft or the autograft. This latter has been successfully done with the sensory nerves of the patient. Often the dead nerve of a young animal can be used, preserved, however, in alcohol, as formalin-preserved nerves are bad.

The great difficulty is in cases such as illustrated by type 2. Professor Marie believes we should not intervene surgically when the continuity of the nerve is preserved. A good way to decide on the condition of a nerve like type 5 is to faradise it after exposure. If there is no response, there is sclerosis. If the current excites a response, then the trouble lies in the binding down of the nerve by adhesions. "Neurolysis" is a term used to describe the surgical liberation of a nerve from those adhesions. It should be done in the case of compression of a nerve, but in a section, partial or complete, of a nerve the keloid must be removed. The musculospiral is a purely motor nerve. The median has sensory fibers and is complex. The result is that when the musculo-spiral is united it gives pretty good results as it has only one function, while suture of the median frequently fails, at least to the extent of bringing incomplete results. Professor Leene has a friend and patient, who was a very brave and stolid man, who had a hematoma pressing on his median nerve trunk in the axilla. The pain was so extreme that he completely went to pieces and threatened to kill himself. Liberation of this nerve and turning out of the clot did away with the causalgia, and he finally became entirely normal. This was purely an irritation of the nerve and the remedy was neurolysis.

For severe pain one could inject alcohol into the sheath of the nerve, but the result can not be controlled and it is better to employ surgical methods. When one sutures a nerve primarily use fine linen thread and only go through the sheath, avoiding coarse needles and tying too tightly. It is well to leave a very small space between the divided ends of the nerve.

Leriche has dissected out the sympathetic plexus from a man's vessel to get rid of the syndrome of compression. It is never wise to suture nerves in a septic wound. The results of grafting the ulnar and median tracts in the brachial plexus and the great sciatic have been bad. It is always well to follow nerve operations by physio-therapy and orthopedic treatment. If you feel reasonably sure that there is danger of paralysis in a bad nerve injury put your extremity in the best possible position and keep it there in anticipation of contracture. Therefore, you hyper-extend the wrist with rubber bands to extend the fingers.

GUNSHOT WOUNDS OF THE NERVES AND THEIR SURGICAL TREATMENT

I can not, in the short time allotted to this conference, study the whole clinical aspect of the question. I will limit my study and describe only: (1) The macro- and microscopical lesions of the wounded nerve; (2) the symptoms of grave lesions of the wounded nerve with the indications for surgical treatment; (3) the technique and result of this surgical treatment.

The frequency and gravity of lesions of the nerves in the present war was unexpectedly great. We did know, however, that lesions of the nerve trunks were produced by bullets in the War of Secession. In that war Mitchell described new types of surgical neuritis following gunshot wounds. After the Russo-Japanese War, a certain number of observations of wounds of the nerves were also detailed. But the extraordinary frequency of wounds of nerves during the present war enabled us to enlarge and perfect our knowledge of these severe wounds.

Wounds of the nerves can be produced by bullets, passing through or near the nerve, and by shell or bomb splinters, sometimes cutting, more often crushing, the nerve. The destructive effects of war missiles on the nerve substance are very much greater than those of the cutting tools which produced the wounds observed in civil practice. I think it is this severe and diffuse bruising of so delicate a substance as a nerve, plus the infection of the wound, that explains the serious prognosis and the unexpected gravity of nerve wounds during the present war.

Anatomically, we can distinguish several types of nerve lesions: Type 1.—Total division of the nerve trunks. This type shows the appearance of a totally sectioned nerve one to two months after receiving the wound. Here the ends are buried in muscles. Fine connective tissue fibers seek to establish reunion, but are functionally of no value. Type 2.—Pseudo-neuroma consecutive upon general bruising of the nerve. This is a contused nerve which at the point of shock has a neuromatous formation. In this fusiform swelling the nerve fibers are mainly replaced by neuroma cells, but a few fibers may still pass and permit a faint conduction of nervous energy. Such fusiform swelling may be from 2 to 4 cm. long. Type 3.—Lateral notching of the nerve. Type 4.—Intra- and extra-neural scar neuroma. Type 5.—Diffuse sclerosis with thickening of the nerve. In this type the main part of the fibrils of the axis cylinders are interrupted and their places are taken by neuroma cells without any fusiform swelling. In this case the nerve is thick and sclerosed.

The first class is rather infrequent; the most frequently observed are the second and the fifth. The relative frequency of simultaneous lesions of the large arteries and corresponding nerves (chiefly in the upper limb, art. axillaris and brachial plexus, art. brachiales and median or ulnar nerves) must be emphasized.

Histologically, the chief lesion observed in all the wounded nerves is sclerosis. This fibrous tissue is very dense (quite analogous to keloid tumors) and causes the degeneration of the nerve fibers included in it, hindering the normal process of regeneration. In the wounds which suppurate, the injured nerves and vessels are always surrounded by the same dense scar tissue formed during the healing process; this scar tissue is the cause of great difficulty in the operative dissection of the nerves.

Clinically, we can describe three great syndromes, whose causes are different. First, those due to physiological interruption of impulses in a nerve; second, those due to compression of the nerve; third, those due to irritation of the nerve.

In the first class, we observe: Complete palsy of the muscles, with loss of the normal tone; loss of cutaneous and deep sensibility; later atrophy of the muscles, trophic disturbances, and electrical R. D. The study of electrical changes in the nerves and muscles is always interesting, but we can not conclude with certainty, after its study, that the nerve is completely or partially divided, or, even, only compressed.

In the second class, the symptoms are very analogous to those of the first class, but deep sensibility is rather often preserved and the electrical R. D. is not always so complete. The prognosis is milder and spontaneous recovery is sometimes possible.

In the third class, painful sensations prevail, causalgia of Weir Mitchell, paroxysms of burning pain, vaso-motor disturbances (cyanotic hand). The motor troubles are very much less severe; but the pain prevents use of the limb. The prognosis is always very serious.

Surgical treatment.—The immediate suturing of a completely or partially divided nerve in a clean wound is evidently the ideal method of treatment. We do not yet know with precision the results of this only recently applied method. But it is certain that the immediate cleaning and suturing of the wounds, as now more and more practiced, will lessen in the future the gravity of prognosis of nerve wounds since the majority have complications which, up to the present, are certainly of infectious origin (suppuration with excessive scar tissue formation).

When the wound is infected and suppurates, it is not wise to try a suture of the nerve; the dangers of septic neuritis are certainly too great. When the wound is healed what ought we to do? The operative indications are somewhat loose and the best neurologists do not entirely agree. But we can affirm that an aseptic exploratory operation is never damaging to the patient. I think, then, that in every case with symptoms of interruption, compression, or irritation, clearly recognized and carefully observed, we ought not to defer surgical treatment. When the wound is opened, the scar tissue dissected away, and the nerve trunk fully exposed, one of several conditions may be observed:

1. When the nerve is quite divided or only united by small bands of scar fibrous tissue, there should be no hesitation. The nerve must be united by a suture; the ends of the separated nerve are lightly trimmed to remove the fibrous scar tissue and these ends are reunited by stitches of very fine catgut passed with fine needles. The stitches ought to be passed only at the periphery of the nerve, through the neurilemma, and it is particularly necessary not to tie them tight. But when a large defect (4 cms. or more) is evident, it will be necessary to bridge this defect between the two ends of the nerve. The only physiological proceeding

is to perform a graft. We know now from the researches of Professor Nageotte that a graft composed of dead nerves of animal (calf) preserved in alcohol is experimentally the best grafting material. When this special material is not at hand, we can make a graft with a fragment of superficial sensory nerve of the patient.

The results of these secondary sutures of nerves, with or without graft, were not till now very successful; nevertheless, favorable cases were published, chiefly for the musculo-spinal and the peroneal branch of the sciatic nerve. The results for the median, ulnar, brachial plexus, and great sciatic nerves are very bad.

2. When the nerve is not interrupted, only notched, or thickened with a larger or smaller neuroma, the opinions of surgeons do not agree. Some, with the authority of Professor Marie, never resect the nerve but only liberate it carefully of the scar tissue (neurolysis); others, with the authority of Professor Deperins, do not hesitate to resect the keloid scar of the nerve and unite it again by suture. It seems very difficult to give a definitive and general rule in such a difficult matter. But I think it is chiefly a question of individual cases.

When the scar neuroma is external to the nerve proper or even internal but enucleable, I think it is safer not to interrupt the continuity of the nerve which has been preserved, but to do only a neurolysis; when hemostasis and asepsis are perfect, this simple neurolysis gives rather often very good results.

But, when the scar neuroma is large and clinically the symptoms of interruption are observed, I think that a resection of the diseased part of the nerve with suture is a logical operation. Some recently published cases agree with this opinion.

When the irritation symptoms are severe, with causalgia, the operation on the nerve alone (neurolysis) is often without results. Some authors advise injecting alcohol into the nerve trunk (Sicard); others, like, Leriche, used to dissect away the sympathetic plexus which surrounds the main artery of the limb, both proceedings have given good results in certain cases.

Finally, it is important to emphasize the always necessary use of orthopedic and physiotherapeutic treatment in cases of nerve wounds.

As soon as possible after the positive diagnosis of interruption of a nerve trunk we ought to give to the patient one of the many prosthetic apparatuses designed to correct vicious positions of a limb (generally it is located in the hand or foot).

Physiotherapy is always useful before and after the operation; it lessens many disturbances presented in the wounded limb (hot air, massage, electricity).

Army Sanitary School No. 115.

CONFERENCE ON TRAUMATIC SHOCK, ARMY SANITARY SCHOOL, FRENCH ARMY, JANUARY 23, 1918

Present: Major General Bechard, jr., chief surgeon of the fifth Army, 75 French surgeons and biologists, and 25 American medical officers.

Presiding: M. Charles Riche, member of the Académie Française.

(Questions appended.)

The conference was opened by M. Leriche, who stated that the object of the conference was not to define shock and we did not know yet, clearly, what it was, but to come to a decision concerning the treatment. He stated that primary shock must be very rare. If so, shock is only secondary to other causes. What are these? Just when does shock appear? There is very little information on this subject.

Does hemorrhage play a rôle? If so, to what extent? He believes that prompt operation often prevents shock, secondary causes of shock are admitted by all: Pain, cold, loss of morale, etc. In septic shock we see improvement and its disappearance in a short time after removing source of sepsis. Leriche states that reflexes are diminished in shock and the pressure of the spinal fluid is very low; the normal being 17, it falls to 6 and 8 in shock. The blood pressure also is low. There is something to be said on the histo-pathology of shock. Are there minute emboli in the brain? There are certainly many cases of shock without injury to the soft parts of bone and consequent liberation of fat; hence fat emboli can not be always the cause of shock. The treatment of shock: Heat is now much used; also transfusion of blood and intravenous injection of salt solution, but nothing as yet is of great enough value to merit the term "specific." Leriche states that spinal anesthesia is dangerous.

M. OKINCZYC (LAPAROTOMIST)

Can not define shock; fear often has a part and the wound is an added cause. There is a great difference between the effect of a wound upon the highly educated man, such as a surgeon, and an ignorant one who has been used to hard labor in the field. In the first the shock is apt to be profound, in the second not so—given the same sort and degree of wound. Shock does not exist in brain cases and it would appear that the loss of consciousness is a preventive of shock. Morphine is absolutely necessary to take away the psychic causes of shock. In fact one should recognize (1) psychic and (2) traumatic shock. Shock must be distinguished from hemorrhage.

M. ROUX-BERGER (CHEST SURGEON, H. O. E.)

All deaths from wounds of the chest can be explained by mechanical respiratory difficulties, by hemorrhage, and by sepsis. He does not believe that shock intervenes in wounds of the chest; hence we should operate immediately and thoroughly. Employ ethyl chloride anesthesia.

M. LEMAITRE (GENERAL SURGEON)

His answers to the eight questions are as follows:

1. "I do not know, but I believe so, although before the war I did not." Never saw a case of shock without injury but believes it exists. The combination of pain, cold, and hemorrhage are additional and all together make "shock."

2. The most important etiological factor is fear; next cold. Psychic influence is marked in shock and pain is a corollary of psychic conditions. Hemorrhage is not necessary to make a picture of shock. Intoxication certainly can produce it, he thinks; shock due to sepsis disappears when source of infection is removed quickly and thoroughly.

Questions 4 and 5 he can not answer.

6. Little, save color of muscles; muscles are brownish red in shock, not healthy red. Cases in shock do not usually bleed very much.

8. Heat is of capital importance. Morphine is good. Normal salt solution is no great value. Has seen good results from subcutaneous injections of oxygen. Don't use chloroform at any price in a military hospital. Advises strongly against lumbar anesthesia.

M. PIOLLET (SURGEON, EPERNAY, AND FORMER ASSISTANT OF CARREL)

The true type of shock is found in multiple wounds, none of which is capable of causing death. The excitement of the attack increases the number of cases of shock due to slight injuries. Fatigue is a potent cause of shock. The higher the development of man the greater the shock. The blacks do not suffer as often or as profoundly from shock as the whites. Long and difficult evacuation of wounded is a cause of shock. Pain is a great cause of shock. There is a low blood pressure in shock (80 to 100 mm. of mercury); when blood pressure reaches down to 40 or 50, death ensues. We must not confuse the effects of hemorrhage with shock. It is dangerous to operate during shock; it does not help—it hurts. But there are some cases in which immediate amputation causes shock to disappear. He believes in the use of morphine and intravenous injection of Loche's serum. He can not see any use in oxygen.

M. LAMBERT (OPERATING SURGEON, CHALONS H. O. E.)

He believes in rapid amputation for severe shock in bad, crushing wounds to the extremities. Has employed spinal anaesthesia, but it had no influence in preventing or increasing shock. If operation is advisable, operate after three-quarters to one and one-half hours in spite of failure of antishock measures.

M. BERTIN (REGIMENTAL DRESSING STATION)

The great point is that there is never any shock to amount to anything seen at the regimental aid station, although pain, cold, and hemorrhage are common. Persistence of these, plus septic intoxication, bring on shock, although pulse may be excellent at first. He had a

case of very slight importance anatomically die of delayed shock at the field hospital, which was not due to unduly long or trying transportation. Some cases of nervous shock are bettered by operation. Heat is the most important antishock treatment. Believes in operating immediately upon all which have but one wound, but antishock treatment is necessary for the cases with multiple wounds. Don't try to find any medicine to correct shock, but prevent it by preventing the causes of shock—cold, etc. Especially important to immobilize fractures and all extremities with bad flesh wounds. Necessary to have better ambulances and a good heating apparatus in them. There are four kinds of shock: (1) Toxic—this may also be due to gas; (2) psychic shock—a primary shock; (3) commotion; (4) emotional shock—use camphor.

M. PIEQUEE (REGIMENTAL SURGEON)

Believes in primary nervous shock, and in amputation to combat shock. He believes in operating on the *mono-blessé* first, and says we should operate in spite of shock, transfusing if necessary later. Transfusion has brought about veritable resurrections. But in the *poly-blessé* you have to treat the shock first before operating.

M. VORVEIUEL (NEUROLOGIST)

There are three different kinds of shock—nervous, toxic, and hemorrhagic. There is commotional and emotional shock. Death can result, due to what is known among the French as "*nevroses' anxieuses mortelles*." The regimental surgeon of the Algerian regiment expressed his belief that emotions have a great deal to do with shock.

M. SANTI (REGIMENTAL SURGEON)

Must remember that shock comes on late, as a rule—not right away.

M. DE LAUNAY (EXPERIMENTAL PHYSIOLOGIST)

Calls attention to tremendous fall of blood pressure after a primary rise, due to exhaustion of the vaso-constrictors. The bombardment will have brought about a great rise in blood pressure at first due to constriction of the arterioles. We should measure the shock of hemorrhage, which causes great fall of pressure, not by the amount of blood lost but by the rapidity with which it is lost.

M. MESTRAEZ (CHEMIST)

Calls attention to the intervention of acidosis as per Cannon's theory in the production of shock.

M. POLICARD (PATHOLOGIST)

Has very little to report as to histological findings in rapid deaths from shock, but in those in which death is retarded he can report loss of lipoid from the nerve cells in the cortical area.

HEMATOLOGIST

In shock there is an absolute and relative mononucleosis.

The discussion was summed up by Professor Charles Richet, member of the Academy of France, and discoverer of anaphylaxis. He began by saying that, as there was no personal question involved in the matter, although there had been considerable animation, he wishes to be permitted to sum up the discussion first and give his own opinion afterward of the little that he knew about shock.

(1) As to primary shock, if it exists, it is at least open to discussion.

(2) Shock must be distinguished from the effects of hemorrhage. In true shock do not depend too much on intravenous injection of salt solution or even on transfusion of blood.

(3) Whatever name you give shock, it is evidenced by a depression of the nervous system, which is the key to the situation. The spirit of man is the key. Depress that spirit and shock comes on. After that comes the effects of cold. In fact, the anxiety before the combat, the fatigue, and, perhaps, cold, all precede shock in many cases and it is thus often initiated. Pain and realization of danger in the intellectual white soldier plays a great part.

(4) The comfort of a man has a great deal to do with the degree of shock. If you want to get your highest degree of prevention, transport rapidly and comfortably. As pain influences the production of shock, morphine should be used. He believes in operating as soon as possible to remove the source of pain, etc., and, therefore, the source of shock. Do not use chloroform; he does not believe in the efficacy of the injection of drugs, but recommends chloralose.

PROGRAM OF THE MEETING OF SURGEONS AND BIOLOGISTS ON THE STUDY OF TRAUMATIC SHOCK

Sanitary Service. Groupment of Surgical and Scientific Services.

Fifth Army, S. P. 223, *January 20, 1918.*

ORDER OF THE DAY

I. Opinion of each surgeon and biologist listed to speak, with observations on subjects mentioned in the following program, or any other points directly concerned in shock.

II. Final general discussion of the principal points taken up by speakers noted.

III. Detailed plan for treating shock in the wounded; suggestions for a continuation of the subject at a later date.

QUESTIONS

1. Does primary shock exist? Leave aside hemorrhage, prolonged pain, chilling of the patient, etc., as well as cerebral or medullary concussion due to an explosion.

2. Secondary shock. Time of appearance. Influences which determine or prepare for its appearance (normal state, pain, cold, hemorrhage).

3. State of the blood in shock, blood counts in pure shock and shock due to hemorrhage; how these may be related and differentiated.

4. Importance of arterial pressure.

5. Nervous symptoms in shock; condition of reflexes and of the spinal fluid.

6. Anatomic, histologic, and physiologic facts in shock.

7. Early operations in shock. Amputation as a means of removing shock by moving the site of the primary lesion. Is there a shock whose source and cause of persistence of symptoms lies entirely in the wound? Septic shock?

8. Efficacy of the different means of treatment, excluding heating of the patient? Morphine; transfusion; injection of artificial serum, serum of Locke and its derivatives, gum arabic, adrenalinized salt solution, etc.; injection of oxygen subcutaneously; emetin.

9. Anesthesia in cases of shock, particularly lumbar anesthesia?

Army Sanitary School No. 116.

ORAL HYGIENE

(Synopsis of a lecture by First Lieut. William H. Potter, D. R. C.)

In order that soldiers may have hygienic mouths they should be taken in hand when children. This is what the German authorities did 12 to 15 years ago when a municipal dental clinic for school children was established in the city of Strasbourg, and later was duplicated in its essential features in many places throughout the Empire. Their soldiers now fighting have the benefit of the care given their teeth in the school clinics and also the accompanying instruction as to the value of teeth and the best methods to preserve them in a healthy condition. School dental clinics have in recent years been established in many parts of the United States and when they become general will exercise an important influence in maintaining oral hygiene in the case of soldiers. The unhygienic mouth conditions found amongst men of the present army are largely due to neglect of the teeth in primary and grammar school days. This neglect may be remedied in the case of soldiers of the future, but we must meet the conditions of the present and the following recommendations are made:

(1) Lectures, illustrated if possible, should be given by a dental surgeon to instruct men as to the value and function of their teeth and to interest them in such care of their mouths

as will lead to oral hygiene. Much of the neglect of the teeth is due to ignorance of their value; what is lightly valued is, as a rule, neglected, and vice versa. Much interest in the teeth can be aroused by a well-planned lecture, which should make clear the following points:

(a) The teeth are necessary for the preparation of food preliminary to its digestion and absorption.

(b) The most important factor in the decay and loss of teeth is the production of lactic acid in the mouth. This attacks the teeth, dissolving their surfaces, forming cavities, and finally bringing about their destruction.

(c) Lactic acid is formed when particles of food composed of starch or sugar are allowed to remain in contact with the teeth.

(d) To prevent decay of the teeth keep them clean.

(e) *Cleaning the teeth.*—Teeth should be cleaned after each meal if possible. If the teeth can be cleaned but once a day, it should be after the last meal, before going to bed. Destructive processes have a better chance at night when the mouth is at rest than during the working hours.

The second most important time to clean the teeth is after breakfast, and the third is after the noontime meal.

(f) *How to clean the teeth.*—Use a moderately stiff brush, and brush as far as possible from the gum tissues onto the crowns of the teeth. A tooth powder helps clean the teeth; if this can not be obtained, use a little soap or a solution of common salt, or even cigarette ashes.

Scraping the top of the tongue helps in oral hygiene. Use a piece of wood about 6 inches long and $\frac{1}{2}$ inch wide, whittled down so that it is very thin and pliable and has a sharp but smooth edge.

(g) *Use of fruit acids.*—It has been shown by accurate experiments that fruit acids are efficient in cleaning the teeth because they break up the adhesive power of mucin causing it to let go its hold on food particles which stick to the teeth. Fruit acids increase the alkalinity of saliva and also its quantity. The saliva has, therefore, greater power to protect the teeth by neutralizing harmful acids and mechanically washing food particles from the teeth.

A practical use of fruit acids can be made by eating an apple or some other fruit at the end of the meal. If an apple is used, the forcing of the teeth into its substance is a mechanical cleansing process and the malic acid of the apple loosens the hold of the food particles on the teeth and increases the quantity and alkalinity of the saliva. While fruit acids produce in the mouth a temporary increase of acidity, it is followed by a prolonged, heightened alkalinity. As a rough and ready way to clean the teeth after a meal, the eating of an apple is recommended to soldiers. It does not make unnecessary the tooth brush, but supplements it and takes the place of the brush when circumstances will not allow its use.

(2) *Prophylactic treatment by the dental surgeon.*—While each man should be taught to clean his own mouth, there are times when he needs help. If tartar or discolorations form they can be removed only with appropriate instruments. Every mouth is improved when its teeth are gone over once in a while by a dentist with polishing sticks or wheels carrying fine pumice. While giving prophylactic treatment the dentist has a good chance to stimulate the interest of his patient in the daily care of his mouth.

(3) *Operative dentistry by the dental surgeon.*—Cavities of decay should be filled, worthless roots removed. Nothing contributes more to an unhygienic condition of the mouth than the presence of cavities of decay which become filled with decomposable food and are favorable growing places for numerous bacteria. Foci of infection about the tips of the roots of the teeth should be carefully sought out and eliminated, either by extraction of teeth and curetting the infected area, or, in certain cases, by cutting off tips of roots in situ, and removing the infected bony socket.

TRENCH MOUTH

This affection demands serious consideration on account of its frequency and disabling results. Its characteristics are those of Vincent's angina and can be thus summarized: Ulcers with irregular outline, covered with whitish gray membrane easily removed. Ulcers are separated by healthy tissue and may penetrate deeply. When the membrane is rubbed off, the surface beneath bleeds readily and is sensitive. Favorite seat of ulcers, near gin-

gival border of mucous membrane, in the region of the second and third molars, especially in the lower jaw. Ulcers may exist on tonsils and pharyngeal tissue. Gums are generally inflamed and sore. Lymph nodes may be swollen and salivation occur. Usually there is a rise of temperature and always a characteristic fetor of the mouth. *Bacillus fusiformis* and Vincent's *spirillum* usually can be found. In some cases the organisms of Vincent's angina are not found, but this may be due to lack of skill or chance. Trench mouth, sometimes called ulcerative stomatitis, is one of the commonest affections among the troops in France. In an examination of the mouths of 1,000 soldiers as reported by F. B. Bowman, M. B., Tor., No. 1 Canadian general laboratory, the conclusion was reached that Vincent's organisms are much more prevalent in mouths that were not cared for than in those which were cared for. The disease in a large percentage of cases is one of unclean mouths. Hence the importance of insisting upon the care of the teeth amongst soldiers.

Treatment: Cleansing the teeth, removal of tartar, filling cavities of decay, extracting worthless roots. The following substances have been used with good results as application to ulcers.

Argenti nitras, 5 to 10 per cent.
 Chromic acid, 5 per cent.
 Cupri sulphas.
 Eusol, Dakin solution.
 Liquor potassii arsenitis.
 Methylene blue, powder.
 Phenol, 5 per cent in glycerine.

Salvarsan, 10 per cent emulsion in glycerine.
 Tincture ferri chloride.
 Trichloroacetic acid.

R Vini ipceaeuanhae	32
Glycerini	4
Liq. potassi arseni-	
tis	16

In addition to making an application to the ulcerated areas, an antiseptic mouth wash should be used frequently during the day. The following can be recommended:

Liquor cresolis comp., 3 to 5 drops in one-half tumbler of water.
 Pot. permangans, 1 to 3,000.
 Dakin solution, 1 in 3 aqua.

The frequent occurrence of trench mouth with men having gonorrhœa and syphilis has been noted by some observers.

Oral hygiene as applied to injured mouth where there are wounds of the face, jaw, and neck.—Such patients are especially liable to secondary hemorrhage and infection of the lungs or general infection. Fatalities from wounds involving the oral cavity are most commonly due to these causes. It is, then, of the greatest importance to so deal with the mouth and associated parts that decomposition and infection be reduced to a minimum. The following régime to be carried out by the dental surgeon is recommended.

All tartar, as far as possible, should be removed from the teeth. They should then be rubbed with a roll of cotton held in dressing pliers and carrying powdered pumice moistened with H_2O_2 . Then the mucous membrane of the mouth and areas about the wounds should be gently gone over in the same way. The tongue should be first scraped with appropriate instruments and then rubbed with pledget of cotton loaded with pumice and H_2O_2 . In this way decomposing and decomposable material is loosened from its position in the mouth, and can be removed by a stream of fluid introduced by a proper syringe or tank douche. If a syringe is used it should have a capacity of at least 1 ounce and a curved nozzle. It is impossible to reach all parts of the mouth with a straight nozzle syringe. If a tank douche is used there should be a curved nozzle glass tube inserted in the rubber tubing. The mouth can not properly be cleaned by simply spraying or washing with a syringe. The preliminary rubbing with pumice and H_2O_2 is necessary to get proper results. When having the mouth washed out it is necessary for the patient to sit up in bed and lean forward in order that no fluid may run backwards and cause strangling.

Various antiseptic mouth washes can be used. It must, however, be recognized that the mechanical action of the fluid is more important than its antiseptic quality. The following can be recommended: Eusol (Dakin sol.) and aqua. a. a.

The treatment here outlined should be carried out every two or three hours during the day in recently injured mouths. Nurses can be trained by the dental surgeon to help in this treatment, but it should not be wholly given up to them during the first 10 days after the injury.

Army Sanitary School No. 117.

LECTURE ON ORDNANCE AND ITS EFFECTS

By Maj. Chester R. Snow, C. A. C. (trench artillery), June 20, 1918.

The term "ordnance" in its broadest sense includes nearly every tool and weapon used in fighting. Thus it embraces everything from the trench knife and war club through machine guns and grenades to the heaviest artillery weapons.

We will consider briefly each of the principal weapons now in use.

Trench knife and war club can not be said to be new weapons, but at least the use of them is new to soldiers of the present generation. Their effect and also that of the bayonet is obvious, so that nothing further need be said of them.

The rifle is the principal weapon in modern warfare. The rifles of the different belligerents differ but slightly in appearance, size, and mechanism and our own .30-caliber Springfield may be taken as typical of all. The bullet is of lead with a cupro-nickel jacket, weighing 150 grains, and has a muzzle velocity of 2,700 foot-seconds. The rifle is sighted for firing up to 2,500 yards, and at 45° elevation it will carry as far as 5,400 yards, or a little over 3 miles. At 200 yards the bullet will penetrate 0.3 inch of steel plate, 60 inches of pine board or greasy clay, about 20 inches of loam, and 9 inches of dry sand. At 600 yards it will penetrate 12 inches of dry sand. This difference in the case of sand is due to the fact that at the shorter range the bullet is deformed by its excessive energy and consequently its penetration is reduced. In all other substances the penetration is greater at the shorter ranges. On account of its great energy, the bullet has great shocking power as well as penetration.

The pistol is a minor weapon in this war. The French officers provide themselves with such pistols as they choose and have calibers ranging from .32 to .45. A German pistol that I have seen was about a .41 caliber. Our Army uses the .45 Colt automatic pistol or Smith & Wesson revolver, using the same cartridge. The bullet is of lead, .45 inch in diameter, the outside being a cupro-nickel jacket. It has a muzzle velocity of 800 foot-seconds, and at ordinary ranges at which a pistol is used it will penetrate 6 inches of pine. A 1-inch penetration of pine is considered the equivalent of a severe wound. This pistol was designed to give a rapid fire and great shock effect. The .38 caliber revolver, which was abandoned for the .45, had a higher muzzle velocity and greater penetration, but not sufficient shock or stopping power. One incident which led to the change to the .45 caliber was the fact that in the Philippines an officer fired six shots from the .38 into a native, who continued his rush and severely injured the officer with a bolo before dropping dead.

The sawed-off shotgun is in use in this war principally for trench cleaners. It is very effective up to 60 yards, and at these ranges is more effective than the rifle on account of the number of shot and their tearing effect.

Grenades may be classified as hand grenades and rifle grenades.

The hand grenades are of two principal types—the defensive and offensive grenades.

The defensive grenade is made with a heavy body checkered with lines of weakness to insure complete fragmentation, and it carries a heavy charge of high explosive. The fragments are killing up to 50 or 75 yards and dangerous up to 100 yards, and hence the person throwing it must take cover in a trench or shell hole to avoid fragments of his own grenade.

The offensive grenade has a body of light tins and contains a large charge of high explosive. Its extreme killing radius is only 8 to 10 yards, the splinters of the light body being very small, and its blast effect is depended upon to do the damage.

Grenades are also filled with smoke compounds, and tear and poisonous gases. These grenades are used by the trench cleaners in clearing dugouts. It is evident that in a dugout a man may take shelter from the fragments of an explosive grenade by going to another compartment or taking cover, but the gas grenades will penetrate to every part, and the

fillers of some are gases which, it is claimed, will penetrate the German gas mask. (British K. J. grenade.)

All modern hand grenades are ignited by a time fuze which lights the powder train as the grenade leaves the hand. The fuses are timed to burst the grenade five seconds later. Grenades may be thrown up to 35 yards, the distance depending upon the strength and skill of the thrower and the weight of the grenade.

Rifle grenades are similar to hand grenades, but are propelled by using a rifle with a suitable attachment for holding the particular grenade. They may be fired by an ordinary cartridge or by a special blank cartridge, according to the particular model. Rifle grenades are filled with the same substances as hand grenades and their effects are the same. The advantage is that their range is greater, being as high as 210 yards. The rifle from which they are fired is usually placed in a special frame so that it may be given any desired elevation. We know that a man in a trench or shell hole can not be reached by a rifle bullet. He can, however, be reached with a grenade which may be dropped into the trench descending at a steep slope. I might add that a grenade is a very dangerous weapon and should be handled only by those who have special training in its use.

Automatic rifles differ from machine guns in being light enough to be easily used by one man. They can be fired by a man advancing, and the rate of fire is up to 60 shots a minute. They use the same cartridge as the regular rifle and consequently their effect is the same.

Machine guns can be fired up to a rate of 400 shots per minute, the rate being governed by the operator by adjusting the gas escape or the special mechanism according to the model. They use the same cartridge as other small arms. In this war indirect fire for machine guns has been developed, and consequently their use in barrage fire. When using indirect fire, the machine guns are placed well to the rear of the target and fire at high angles. Consequently the slopes of fall are very steep and overhead cover is needed for protection against it.

We next come to the weapons of the artilleryman, or what is termed ordnance within the most common meaning of the word.

The artilleryman's weapon consists essentially of the tube or barrel, the carriage on which it is mounted for firing, the explosive used both as a propellant and as a bursting charge for the projectile, and the projectile.

The barrel of the gun is very interesting in itself in the ingenious methods used to make it withstand great internal pressures, but time will not permit us to consider its construction.

The carriage has two purposes: To take up the recoil and to direct the fire. This second purpose only concerns us. We classify fire into three kinds according to its use, namely, direct fire, where the gun is fired at angles up to 15° ; curved fire, when the projectile departs at angles between 15° and 45° and high-angle fire, when the angle of departure is between 45° and 90° . Guns designed especially for curved fire are called howitzers, although in the present war all guns are mounted so that they can be fired at angles up to 45° . Guns designed for high-angle fire are called mortars. The needs for these classes of fire are readily seen. Suppose we have a target which is greater in dimension vertically than horizontally, as the walls of a building. Direct fire is the most useful. Suppose we must fire over a high hill or a woods. Obviously curved fire is called for; while if the target presents greater vulnerability on top than on the sides, as the top of a building or shelter, we need high-angle fire. The kind of carriage provides for this.

The subject of propellants leads us to consider explosives. An explosive is a solid or a liquid which can be readily converted to a gas. An explosive consists essentially of a combustible substance, as carbon, and an oxygen producer, as a nitrate or chlorate.

Explosives are divided into three classes: (1) Powders or propellants, (2) detonating explosives, and (3) detonators.

Powders or propellants burn in the same manner as wood or coal, only, having their oxygen contained within them, they burn at a much greater rate and this rate increases with the temperature and pressure under which combustion takes place. Keep in mind for the moment that it is simple combustion, and then we can contrast them with the second class, or detonating explosives or high explosives. In these we do not have combustion, but rather an instantaneous disruption of the force which binds together the atoms in the molecule, which causes

the atoms to depart from their present comparatively unstable combinations as nitrates or chlorates and form more stable ones as carbon dioxide and nitric oxide, and others according to the composition of the explosives. This class of explosives is used in blasting and as shell fillers.

The next class is the detonating explosive, which is characterized by mercury fulminate. Explosives of this class are not only of a higher order of detonation than those of the second class, but they have the power of initiating detonation, or the disruption of the molecular bond in explosives of the second class. Take, for example, trinitrotoluene, a high explosive and a most common shell filler. If we ignite it with a match in the open it will melt and slowly burn. If we light it when confined it will burn more quickly, but will cause an explosion only as the gases accumulate from the rather rapid combustion. But if we explode some mercury fulminate in contact with it, we immediately obtain a detonation of the whole mass.

High explosives have individual characteristics, and their utilization as shell fillers is governed accordingly. Picric acid, for example, is comparatively insensitive, but very quick and of great disruptive power. It, or some of its compounds, is the almost universal filler for high-velocity shells. The speed of these explosives is such that it tends to disrupt rather than remove material. On the other hand, certain chlorate explosives have 50 per cent more power of removing earth than the picrates. They are used more for the destruction of dug-outs, but their great sensitiveness limits the use to shells of low velocity.

Projectiles, as regards their effect, may be classified as follows:

1. Shrapnel.
2. High-explosive shell.
 - Air or time fuze bursts.
 - Ground or percussion fuze bursts.
 - With instantaneous fuze.
 - With nondelay action fuze.
 - With delay action fuze.

The shrapnel consists of a case with a charge in the base and the rest of the case filled up with balls of lead or iron about an inch in diameter, and the interstices filled with a smoke-producing compound, which is useful to show the point of burst in order that the fire may be adjusted. Shrapnel is used mostly in guns of about 3-inch caliber, as the French 75 and the German 77, and such a shell will contain about 260 of these balls. The head of the shrapnel holds a combination time and percussion fuze, the time fuze being an arrangement by which the interior charge is ignited a certain length of time after the projectile starts, and causes the balls to be projected forward. The percussion element of the combination fuzes detonates upon hitting the ground in case the shrapnel does not burst in the air. The effect of shrapnel is to sweep a cone-shaped area, the area varying in size with the height of the burst, the higher the burst the more area covered and consequently the thinner pattern made by the 260 balls. The penetration of the individual balls is slight, 10 cm. of earth giving protection, and shrapnel is of slight use against troops under cover. However, it may be effectively used against troops in open trenches by enfilading the trench or by bursting the shrapnel at such a point in the trajectory that the cone of dispersion will be directed downward.

High-explosive shells, equipped with a time fuze, are fired from both field guns and howitzers. The field gun is a high-velocity cannon having a flat trajectory. A shell, from the German 77, for example, bursting in the air will give a cone of dispersion of the form shown, the direction given to the fragments being the resultant of the forward movement of the shell and the lateral motion imparted by the bursting charge.

The howitzer uses curved fire and low velocities. Therefore, the air burst of a shell fired from a howitzer, the German 105 for example, will give a somewhat different dispersion of the fragments, throwing some directly downward and to the rear. The rearward motion of the fragments is due in part to the steep slope of fall of the projectile and to its low velocity.

The thing to note in regard to these shells is the fact that while a trench may give cover against the 77 high-explosive shell, overhead cover is essential for protection against the shells fired from howitzers. The fragments from these shells are very numerous and very irregular in shape, and at first are propelled with great speed, which they rapidly lose. The penetration of the fragments is not great except close to the point of burst.

The high-explosive shell with a percussion fuze will give three effects, according to whether an instantaneous, a slight-delay action—say, one twenty-fifth second—or a long-delay—say,

one-sixth second—action fuze is used. The instantaneous fuze, as its name indicates, detonates the projectile the instant it strikes the ground. It makes very little, if any, crater, and the fragments are projected horizontally in all directions, making a very destructive projectile against personnel or wire entanglements. The slight-delay fuze or nondelay fuze makes but a small crater—say, from 6 inches to 1 foot deep—and sends part of its fragments and the material from the crater upward and downward at varying angles depending upon the depth it has penetrated and the strength of the explosion. We may have craters, with the resultant flight of débris and fragments.

The high-explosive shell with the long-delay action fuze is used against shelters and dugouts, the idea being that it shall not detonate until it has penetrated the ground a considerable distance. An ordinary 6-inch shell with delay action in soft soil makes a crater about $1\frac{1}{2}$ m. across the top and about 1 m. deep. A 58-mm. trench mortar bomb will make a crater 2 or 3 m. in diameter and about 2 m. deep.

In some cases a shell will penetrate the ground so far that the explosive contained in it has not sufficient power to raise the earth above it. In this case we have what is called a camuflet. Such a burst near a dugout is very destructive.

One case I have observed is interesting in connection with protection fuze shells. You will notice that most all old soldiers drop very quickly to the ground when a shell is heard approaching. The value of this is proven. A shell dropped 40 feet from a group of men without cover; 6 of them were hit by fragments, 2 being killed instantly and 3 severely wounded, but in no case was one of them hit less than 24 inches above the ground. One man still nearer to the shell heard it coming and dropped to the ground. He was not hit. The evidence shows that had all the men dropped instantly to the ground none would have been hurt. This shell was about 105 mm. caliber. It had a very quick fuze and made a crater only about 9 inches deep and 24 inches in diameter. Some fragments were about 2 cubic inches in size.

So much for the effect of the shells themselves. The destruction done by the shells will be influenced by the way in which they are used, and this has changed in a very marked manner from that of previous wars. These changes may be considered as:

1. The greater proportion of guns of large caliber in use.
2. The greater number of guns of all calibers in use and the consequent prolonged and violent artillery activity.
3. The use of barrage fire, which is made possible by the great number of guns.

The great number of guns and the large assortment of calibers, with ranges varying up to 38,000 m. has enabled the guns to be distributed in depth. Consequently, on a given length of front many more guns may be used than formerly, and targets at a greater distance behind the lines may be reached. The use of a greater number of guns of all calibers has enabled the density of fire to be increased. More enemy guns must be put out of action before one side remains with a marked superiority of artillery. The long ranges of the guns enables them to have a greater choice of positions from which to fire, and consequently more time is required to search them out and neutralize them.

The great density of fire permits the use of the barrage or curtain of fire, which is made by all guns, including machine guns, being directed upon points so that the whole makes an impassable barrier. When a barrage is put down the bulk of the fire is directed at trench junctions, communication trenches, and roads where the enemy would most probably try to pass.

These points of dense fire can be learned by observation, and one can use this information to advantage should it be necessary to attempt a passage through a barrage.

Army Sanitary School N. 118.

DIRECTIONS FOR THE OPERATION OF PERSONAL HYGIENE SECTIONS

(Translation of a French pamphlet)

Personal hygiene sections (P. H. S.) are special organizations of the "service de santé," whose aim is to insure the individual cleanliness of the men, the "disinsectization" and the disinfection of personal belongings and the issuing of clean linen. They contribute, therefore, to preserve the health of the soldier, being at the same time a means of prophylaxis against contagious diseases.

The P. H. S. are army units placed under the authority of the army surgeon, who determines their use according to the indications of the general commanding the army. They work under the control of the directors of the "service de santé" of army corps or of the division surgeons. The order of bathing of troop units (regiments) is regulated conjointly between the command and the "service de santé." The chief surgeons take advantage of the hours of bathing to make an individual inspection of the men in order to detect parasitic and contagious diseases.

PERSONNEL

The personnel of a P. H. S. includes: 1 noncommissioned officer (auxiliary physician or assistant pharmacist, M. C., sergeant, or "top sergeant"), 2 corporals, 3 mechanics, 10 corps men, 1 of them a barber.

This personnel receives practical instruction at the central workshops of the "service de santé"; it forms a special detachment which is, for administrative purposes, attached to the nearest permanent sanitary formation designated by the army surgeon.

It is considered a specialized personnel.

The task of the mechanics is to operate, maintain, and to look over the boiler, the drying place, the pipe system, cocks, valves, and, in general, everything pertaining to the mechanical side of the organization.

Corps men are employed especially in loading and unloading operations and in setting up and striking tents. They insure the working of the different services under the supervision of the section chief.

MATÉRIEL

The matériel is described in the summary appended. It is in charge of the section chief.

OPERATION

Everything being prepared, the rooms are heated or ventilated according to the existing temperature.

The mechanic in charge of the drying room makes sure that the tank is filled and that the thermometer marks the desired degree (40° C. more or less).

Soldiers entitled to use the showers are divided into groups of 40 men. Every group enters first a "tortoise" tent serving as dressing room; each man leaves in a numbered bag (from 1 to 40) his valuables—watch, pocketbook, purse, etc. These bags are placed in a basket provided with a padlock. On delivery of the bag to the attendant, each man is given a wooden tag bearing the corresponding number.

Once relieved of their valuables, the 40 men making up a group step into room A, furnished with benches numbered from 1 to 40; with each numbered seat goes a net, also numbered to correspond.

Each man walks to the place marked with the same number of his tag, undresses, puts his clothes in the net and enters the shower room (room B), carrying his shoes, helmet, and gas mask. He places all these objects, together with his tag, in a cubby-hole of a set of shelves bearing his number, and takes from a special container enough soap for his own use. Underclothes are left on the floor of the dressing room, where they are collected and taken to the soiled linen room by the corps man on duty before the next group of men moves in.

After the men have assembled in the shower room, they are separated in two series; the first, comprising Nos. 1 to 20, and the other, Nos. 21 to 40. The men of the first series are first exposed to a short shower and are immediately thereafter replaced by those of the second series. The men of the first series soap themselves and again take their places under the shower heads and finish their bath. They now dry themselves with a towel provided them by the corps man on duty; get their helmet, shoes, gas mask and tag, and pass to room C, where they take their places on benches according to their tag number.

The men of the second series go through the same maneuver in their turn.

While the men are bathing, the nets containing their clothes are being disinfected and dried in the autoclave. This operation lasts from 25 to 30 minutes, according to the hygro-metric index of clothing; it is the duration of the autoclave that regulates the number of men that can be admitted per day. In room C the men find on each seat bearing a number, one

shirt, one pair of drawers, one flannel undershirt, one pair of socks. These are distributed in advance by the corps man on duty. They are given their outer clothing, disinfected and dried. Before leaving they turn in their tags in the dressing rooms, in exchange for which they get back their valuables.

In order to insure a distribution of linen according to the size of the men, it is advantageous to sort them according to their height, No. 1 being assigned to the tallest.

Before passing the men through the shower, the barber of the section, assisted by the company barbers, shave and trim the hair of each man.

Such is the routine followed by a P. H. S.

ISSUING OF LINEN

Clean linen is issued by the quartermaster upon requisition of the chief of the section. A reserve of 10,000 sets (shirts, drawers, undershirts, socks, towels, handkerchiefs) is constantly kept in store.

Soiled linen is passed through the autoclave in the evening, and thereafter taken to the quartermaster, who is in charge of washing and exchange of worn-out clothing.

APPLIANCES AND ERECTION OF A PERSONAL HYGIENE SECTION

A personal hygiene section includes: One boiler mounted on a two-wheeled cart; 1 autoclave and 1 shower tank, mounted on another two-wheeled cart; 1 portable hut, composed of canvas-filled frames or panels, making up three rooms (undressing, showers, dressing); 3 tents serving, respectively, as vestiary, clean-linen store, and soiled-linen storeroom; accessory fittings and mountings, whose nomenclature is given further on.

All requisitions for new appliances or for important repair work must be made on the central workshop of the "service de santé" by the chief of the section.

BOILER

The boiler is of the "field" type, tubular, vertical, with a heating surface equivalent to 6 sq. m.; it is measured up to 6 kilos pressure and provided with the necessary gauge and safety appliances.

The feeding of the boiler is secured through an injector whose water valve is located in the shower tank so as to obtain pressure and, at the same time, already heated water. The stack for the fire box, made of sheet iron 3 mm. thick and provided with a spark arrester, is set above the boiler and projects 1 m. 50 cm. above it. It can be taken down and easily fastened to the boiler cart for transportation.

The boiler is provided externally with a water gauge set in a metallic bearing box, splinter proof, to avoid danger in case of rupture.

Above the fire box, at a man's height, the boiler has a distributing system of three valves, commanding, respectively, three pipes, leading to (1) the steam distributor for the autoclave; (2) the feeding apparatus of the boiler; (3) the fire-box blower of the boiler.

To start the boiler, the stoker lets in, through a small funnel placed on top, the necessary volume of water. He next fires the furnace and regulates the draft by means of the blower; he endeavors to keep the necessary pressure; that is, 6 kilos to a square centimeter, determined by the manometer (pressure gauge). When the steam is up the shower tank is filled through its ejector system, as explained later on, and the feeding of the boiler is carried out by means of the injector, whose water valve is cast in the shower tank.

The boiler is mounted on a two-wheeled carriage, whose seat and shaft can be easily removed.

This vehicle is drawn by two horses hitched in tandem.

The total weight of the boiler carriage with road equipment is 1,450 kilos.

AUTOCLAVE

The cylindrical autoclave is double doored, measures 1 m. 10 cm. interior diameter by 2 m. 25 cm. in length, measured from the exterior of the convex doors. The doors are kept shut by means of articulate bolts with round screw nuts and handles. The autoclave is fitted inside with sheet iron down to about 10 cm. from the horizontal axle, to prevent

damage to the clothing by direct contact with the water of condensation and steam. A heating battery, consisting either of a steam chamber or of a series of steam pipes, is located in the lower portion of the stove and constitutes a source of heat which lessens the cooling down while the clothes are being introduced and taken out; it also prevents the condensation of steam at the beginning of the operation.

The operations of disinfection and of "disinsectization" are carried out by the use of flowing steam maintained at 750 gm. pressure.

Clothes to be disinfected, as we have seen, have been previously inclosed in netting bags, one complete outfit to a bag (breeches, coat, overcoat and a pair of puttees). Each disinfection takes care of 40 outfits of clothing. It should be announced that all rubber and leather included in the net bag will be completely ruined.

STEAM DISTRIBUTING SYSTEM OF THE AUTOCLAVE

The distributing system on the right side of the autoclave, toward the undressing room, within reach of the autoclave operator who remains in room A, is connected with the boiler by means of a flexible steam pipe. From this distributor spring (1) a pipe extending to the upper part of the autoclave serves to convey the steam for the disinfection; (2) a pipe going to the heating battery of the autoclave; (3) a pipe feeding an ejector destined to force water under pressure into the shower tank; (4) a pipe going to a mixer which makes possible the sending at will of steam into the water of the shower tank, to regulate the temperature within the desired limits (38° to 42°); (5) a pipe leading to an ejector destined to secure drying by creating a partial vacuum (this produces a vacuum by carrying off the steam which is in the chamber and whose place is filled by the vaporization of the moisture in the clothing).

TANKS, SHOWERS, AND ACCESSORIES

The tank containing water used for showers consists in a sheet-iron cylinder, entirely closed, set on top of the autoclave and mounted on the chassis of the same carriage. It is fed through a rubber hose 15 m. in length, ending in a strainer plunged in water, by means of an ejector which receives the steam from one of the distributing valves. The suction pipe for the water carries an air passage served by a stopcock which permits the introduction of compressed air into the water of the tank. Thus it is feasible to obtain a shower force with pressure varying between 100 gm. and 1 kilo. The man in charge of the autoclave regulates the pressure to impart more or less violence to the jet, according to whether it is necessary to rinse after soaping or simply to wet the men.

Pressures over 1 kilo are avoided by a valve cast on the upper part of the tank and regulated for 1 kilo; a metallic manometer gives the pressure of the shower. It should be noted that the pressure thus obtained is absolutely necessary to insure a proper force of the shower, furthermore, it prevents the obstruction of the holes of the sprinkler through small foreign bodies.

A pipe system proceeds from the lower portion of the tank to the shower distributing pipe of the shower heads. It is fitted with a stop cock. There are two of these distributing pipes, each supplied with 10 shower heads; they are fixed to the trusses of the shower room.

That the shower may prove comfortable and adequate from a sanitary standpoint, it is essential that its temperature be regulated to about 38°, summer and winter. The temperature desired for the water is produced, on the one hand, by the working of the ejector feeding the tank, which raises the temperature of the water drawn from the outside about 15°, and, on the other hand, by the mixing, which may be varied in intensity, of the water in the tank with the steam coming from the distributor through a special pipe fitted with a gradually opening valve.

In order to obtain the exact temperature, the admittance of steam to the mixer is regulated according to a thermometer which marks the temperature of the water as it leaves the tank. As a safety measure, when this thermometer shows a temperature of 45°, an electric connection is established which rings a bell. The thermometer, the autoclave manometer, and a clock serving to give exactly the duration of the autoclaving are all fixed on a plate set above the autoclave.

The autoclave and the shower tank are mounted on one two-wheeled carriage drawn by two horses hitched in tandem. The total weight of the autoclave carriage with road equipment is about 2,000 kilos.

HUT

The portable hut for a P. H. S. has three rooms: A, B, C, disposed of as shown on the plan, and provides an undressing, a shower, and a dressing room.

This hut consists of: (1) A floor supported on sills; (2) vertical partitions of canvas panels, interchangeable and double walled; (3) a canvas cover resting on trusses which are laid on top sills resting on the wall panels.

Floor.—The floor is composed of interchangeable sections, adjustable on the sills without being fixed in place. To facilitate its erection the external face of external ground sills are painted green.

In the center of the shower room, gratings are substituted for the painted panels of the same dimensions.

Wall sections.—Wall sections consist of a wooden frame braced with one transverse piece and two ties. This frame is covered on both sides with well-stretched canvas. On the outside awning is used, while for the inside rough cloth is sufficient.

The interior partitions separate the dressing and undressing rooms from the shower baths.

The lower transverse pieces of each section carry two round pegs, 14 mm. in diameter and 35 mm. long, fitting in holes bored in the ground sills.

Furthermore, the fitting of sections one to the other is made solid by a screw-clamp whose two pins fit into holes bored in the panel frames. The fitting of corner sections is accomplished in the same way.

Cover.—Above and on the inside of the longitudinal wall section is affixed a top sill which supports six trusses, designed to sustain the canvas roof. The general appearance of one of these trusses is seen in the plan, which also gives the details for joining the top sill to the tie beam of the truss.

The carpentry work of the roof is completed by rafters supported by the top purlin, the intermediate purlin, and the top sill.

One piece of awning is affixed by means of ropes to the top purlin of the dressing and undressing rooms, covering these two rooms. It is fastened to the gables and to the front panels by means of a side rod.

Another piece of awning is fastened to the top purlin of the shower room, covers this room, and is attached to the lateral sections as in the preceding case.

The interval between the two top purlins is covered with canvas curtains forming roller blinds; these curtains can be reefed so as to allow proper ventilation. For lighting, the roof admits of four sections to each room, made of oiled cloth, 2 by 1 m. in size.

In addition, each room is provided with a velarium of white cloth to isolate a portion of air beneath the awning forming the roof; the air layer thus confined between the velarium and the awning as also the air layer inside the panels, act as heat insulators and permit an even interior temperature of the bathroom even during the severest cold spell. The necessary ventilation to avoid excessive heat in summer and also to insure the removal of over-charged air is secured through the set of curtains covering the interior between the roof purlin of the shower room and those of the dressing and undressing rooms.

Doors.—The wall sections are provided with doors leading outside of the building; there are 5 of them, distributed as follows: 2 in the undressing room, 1 in the shower room, 2 in the dressing room. The inside partitions have two connecting doors; one leading from the undressing to the shower room, the other from the shower to the dressing room.

Opening frames.—There are 2 window frames covered with transparent cloth in each of the 2 dressing rooms and 5 in the shower room.

TENTS

To the hut are annexed several tents for accessory services, viz, one store or supply tent to keep the reserve of clothing outfits; one tent for barbers and chiropodists; one tent serving as a depository for the valuables of the men, turned over before undressing.

The tent serving as clean-stockings store is a Bessonneau of the large type.

The barbers and valuables tent and tent serving as soiled linen store are "tortoise" tents, small type, covering an area of about 15 sq. m.

ACCESSORY APPLIANCES

These appliances include:

- (a) The necessary pipes and distributing pipes for operating the boiler, stove, and showers.
 - (b) Twenty folding benches for the two dressing rooms, of lattice work, of the following dimensions: 1 m. 40 cm. by 60 cm. (each bench for 4 men, 2 on each side).
 - (c) Two sets of portable lockers, comprising each 20 numbered compartments, wherein the men deposit their helmet, shoes, and gas mask. The dimensions of the compartments are 30 by 35 by 40 cm.; each locker covers a space of 60 sq. cm. They are located in the shower room.
 - (d) Three series of 40 nets, numbered the same as the valuable bags and tags. These nets are 40 cm. diameter by 65 cm. in height. They contain the clothes to be disinfected; that is, a complete outfit (breeches, coat, overcoat, and a pair of puttees).
 - (e) Three series of bags 14 cm. in diameter and 20 cm. in height, numbered 1 to 40, to deposit in the valuables (watch, pocketbook, flat purse, knife, etc.).
- These bags are placed, for the duration of the shower period, in locked baskets; after the operation they are returned to the men holding tags corresponding to the numbers of the bags.
- (f) Three series of wooden tags, 7 by 5 by 1 cm., numbered up to 40. These tags are issued to the men together with the bags, the numbers on both corresponding.
 - (g) Three wicker baskets with lid, to contain the valuable bags. They are 1 m. 15 cm. by 72 by 30 cm. in size. These baskets, once closed, remain under guard of the attendant in the tent designed to receive them.
 - (h) The necessary equipment for the barbers.
 - (i) Small implements.
 - (j) Wedges of diverse thicknesses serving to level the ground sills of the hut.

TO SET UP THE BUILDINGS AND TENTS

Selecting and preparing the ground.—The location of a personal hygiene section must, as far as possible, meet the following conditions:

- (1) It must be in immediate proximity (about 15 m.) to a well or source of clear water, such as a river or creek with a minimum delivery of 1 liter per second.
- (2) The ground must be sufficiently even to allow the erection of tents and huts, covering an area of about 500 sq. m.
- (3) It should not be over 3 m. higher than the source of water supply.

On the site thus chosen and on the spot where the gratings for the shower baths are to be placed, a slope or glacis is built with gradient of 3 cm. to the meter, 8 m. 65 by 2 m. 25 cm. revetted with corrugated iron furnished by the engineers, having at its lower point a drain, through which the used water runs into a down gutter. The use of a drainage basin where water becomes stagnant is to be rigidly proscribed.

Setting up the appliances and huts.—The mechanics fix the position of the portable autoclave and boiler and remove seats and shafts; they connect the distributing system of the boiler with the distributor of the autoclave by means of a flexible pipe and the feeding injector of the boiler with the shower tank; they then fill the boiler and start the fire.

The corps men, under the supervision of the noncommissioned officers, are distributed into three groups:

The first group sets up the undressing room; the second group sets up the shower baths; the third group sets up the dressing room.

The ground sills, sorted according to their color, are carefully set in place and leveled with the aid of wedges; this requires more time than any part of the preparation.

After the ground sills are in place, the floors and gratings are adjusted; this operation is greatly facilitated through the use of interchangeable sections. It takes about two hours to finish it.

The principle of the hut lies in the fact that there are no uprights to hold the panels and the woodwork; hence the operation becomes a simple one; the panels are set side by side and held together through the sills and screw clamps; trusses are mounted directly upon the panels and are tied together with purlins; on these the rafters are fixed, which will be covered

with canvas. For transportation purposes this canvas is rolled up parallel to its shortest dimension. To mount it, each roll is hoisted with the aid of ropes sliding over the top purlin. The side rods to fasten the canvas to the panels are only fixed at the end, being careful never to tighten them to the limit. It is important, before laying the roof, to set the four batter posts of the façade opposite the center trusses of the small rooms.

While the corps men are disposing the benches and numbered nets in their places the mechanics adjust the distributing pipes for the shower to the tie beams of the trusses.

The section is now ready for use.

A trained detachment completes this work in about eight hours.

Army Sanitary School No. 119.

HISTOBACTERIOLOGICAL CYTODIAGNOSIS OF WAR WOUNDS

A demonstration by Maj. G. Rosenthal, chief of laboratory at the H. O. E. de ———.

(Translation of summary)

Every recent war wound and every foreign body removed must be subjected to bacteriological examination.

The examination includes two steps:

1. Examination of smears.
2. Making of cultures in order to rapidly determine the nature of the microorganisms.

A. EXAMINATION OF THE SMEARS

Always make two smears on separate slides.

The first one is stained with a carbolic solution of methylene blue or thionine; the second one by the gram method with gentian violet.

Examination of the smears considers:

1. The leucocytes, defensive elements, and distinguishes—
 - (1) Whether poly or mono nuclears predominate.
 - (2) Their relation to the intra and extra cellular organisms.
 - (3) Their state of preservation.

One must consider as favorable: A good coloration of the nucleus; a good contour; a predominating number of cells.

2. The microorganisms, in a recent wound (during the first week)—

- (1) Large bacteria, Gram-positive, with square ends. This is the perfringens group; look out for gas gangrene.
- (2) Cocci in long chains of 12 to 30 elements, all alike in the same chain and Gram-positive. This is probably the true streptococcus; never close such wounds.
- (3) Indifferent organisms—
 - (a) Gram-positive cocci (diplococci with an aureola; enterococcus; bunches of diplococci; staphylococcus; isolated cocci).
 - (b) Gram-negative bacilli (belonging to the *B. coli* group).

Cytodiagnosis to establish three types:

- (1) Defense—innumerable organisms and no leucocytes (attack without defense).
- (2) Victory—two forms:
 - (a) Few organisms, numerous polynuclears in good condition.
 - (b) No organisms; polynuclears in bad condition; watch the general condition of patient.
- (3) Struggle:
 - (a) Danger of gas gangrene if big Gram-positive bacilli.
 - (b) Danger of septicemia if streptococcus (don't close).
 - (c) Favorable type if diplococci and Gram-negative bacilli, with leucocytes in good condition.

B. THE CULTURES

1. Are made in numerous streak inoculations on an ordinary agar culture tube and in broth; indispensable to detect streptococcus.

2. Inoculation with a sealed pipette of milk by the Rosenthal method and in a Veillon gelose tube. Milk is the best medium for *perfringens*.

After 12 hours, examine the cultures.

1. The agar tube may show:

(a) Large colonies of staphylococci (Gram-positive clusters of cocci).

(b) Large colonies of *B. coli* (Gram-negative, groups of small bacilli).

(c) Abundant fine colonies of enterococcus (diplococci in short chains with an aureola).

(d) Fine colonies like tapioca grains, or dewdrops very close together; streptococcus (long Gram-positive chains composed of homogenous elements).

2. The broth tube may show at the end of 8 hours a growth of streptococcus (clear broth with a bread-crumb deposit). Note that the streptococcus grows in long chains in the broth; the smear alone might be misleading.

3. The sealed milk tube reveals *B. perfringens*.

(a) The clot is retracted.

(b) The serum is clear.

(c) The gas collects under the lanoline top layer.

Note that massive coagulation of the milk is of no value.

4. The agar in the Veillon tube is broken up by the gas.

C. POSSIBLE ERRORS AND REMARKS

An indifferent organism may simulate *perfringens*; the error is exceptional, because morphologically similar bacteria appear late in old wounds; the error causes the patient no harm.

Common germs like *proteus*, *subtilis*, and *paracolibacilli* occur late and are of no interest at the front.

Differentiation of the varieties in the *perfringens* group (mobility, character of spore formation, fermentations of *vibrio-septicus*, *B. oedematicus*, *B. bellonensis*, etc.) and differentiation of the cocci in staphylococcus and *micrococcus candidus* are purely of scientific interest. Up to the present they are of no practical value in the clinical control of wounds.

FOR FIXING TISSUES—BOUVIN'S SOLUTION

Formol (40 per cent).....	10
Water.....	30
Acetic acid.....	2

Let rest one to three days. Pass to alcohol without washing in water.

Army Sanitary School No. 120.

ARMY SANITARY SCHOOL,
ARMY SCHOOLS, A. E. F.

The following suggestions have been submitted by Lieutenant Colonel Allison, M. R. C., and are recommended to all student officers of this school as representing the basic principles which this school is teaching.

NOTES ON THE SURGICAL SUPPLIES AND SURGICAL TREATMENT IN A COMBAT DIVISION

1. *Supplies of splintings, dressings, and accessories.*—The division medical supply officer will requisition and obtain from the advance medical supply depot the following list of splints and splint accessories and will distribute this supply in the quantities indicated to the various units of the division. What remains he will hold in his supply depot as a reserve supply.

Division supply of splints and accessories

Distribution	For each						
	Com- pany dugout	Battal- ion aid post	Ambu- lance com- pany	Ambu- lance dress- ing station	Field hos- pital	Non- com- bat unit	Total for di- vision
Thomas half-ring thigh and leg splints (B. K.).....	4	8	60	10	104	4	540
Thomas arm splint, binged (Murray's modification).....	2	4	40	10	10	2	300
Cabot posterior wire leg splint.....	4	8	50	10	20	4	700
Jones humerus traction splint (right and left).....	0	0	0	0	12	0	^a 48
Ladder splints.....	12	24	100	25	25	12	1,725
Thomas traction arm splint.....	0	0	0	0	10	0	40
Wire gauze (rolls).....	5	10	50	15	25	5	600
Light splint wood (3-foot and 4-foot lengths).....	2	4	50	10	10	2	^a 450
Long Liston splints.....	0	0	2	1	2	0	20
Jones cock-up splints.....	0	0	0	0	10	0	50
Litter bars.....	0	6	25	10	25	2	300
Triangular slings.....	24	48	260	50	150	25	3,700
Cotton (batting-wadding) rolls.....	10	25	200	50	200	10	2,700
Muslin bandages.....	12	12	100	25	100	12	2,500
Zinc oxide adhesive plaster.....							200
Foot and 5-yard rolls.....		2	12		10	1	400
2-inch rolls.....	1	6	36	12	12	6	400
Supporting slings (3 sizes).....	0	0	0	0	100	0	400
Straps and buckles (2 sizes).....	12	24	50	20	50	12	1,500
Paper clips.....	0	0	0	0	250	0	1,000
Wire leg rests (for Thomas splints).....	0	0	75	25	50	0	500
Trench litters.....	2	4	0	0	0	0	75
Sinclair glue.....	0	0	0	0	^b 1½	0	^b 2

^a Each.^b Kilos.

Additional surgical supplies: In addition to the combat equipments supplied by the Medical Department to the division, the following list of surgical supplies should be obtained and distributed to the various units.

Front dressing packets:

1. Red (small).....	6,000
2. White (medium).....	4,000
3. Blue (large).....	2,000

Total.....	12,000
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Blankets (extra).....	1,000
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Burners, blue flame, Primus type.....	50
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Hot-water bottles.....	200
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Acetylene lamps.....	50
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Carbide.....	pounds— 300
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Tea, chocolate, and sugar.

Oil for blue-flame burners, primus type.

Antitetanic serum (1,500 syringes).....	20,000
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NOTE.—The above list of supplies is approximate only and is subject to variation according to the military situation.

2. *Details of distribution.*—(A) The battalion aid post, Infantry and Artillery.

The battalion surgeon will establish his post in the rear of his battalion and will so arrange its equipment that it may function as a first-aid station for the treatment of the wounded. He will direct the Medical Corps men and stretcher bearers assigned to his battalion for duty in such a manner that the wounded will receive prompt and efficient attention. He will administer antitetanic serum (A. T. S.) to all wounded (1,500 units). He will properly splint and dress fractures and wounds and treat shock and hemorrhage. His duties require coolness and precision. During quiet times he will instruct and give practice to the Medical Corps personnel under his direction in the proper application of splints, the dressing of wounds, and the necessary measures to combat shock. At the battalion aid post he will maintain the supplies following.

Thomas half-ring thigh and leg splints (B. K.).....	8
Thomas arm splint (hinged), Murray's modification.....	4
Cabot posterior wire leg splint.....	8
Ladder splints.....	24
Wire gauze (rolls).....	10
Light splint wood (3-foot and 4-foot lengths).....	4
Stretcher bars.....	6
Triangular slings.....	48
Cotton (batting-wadding) rolls.....	25
Muslin bandages.....	12
Zinc oxide adhesive plaster:	
Foot and 5-yard rolls.....	2
2-inch rolls.....	6
Straps and buckles (2 sizes).....	24
Trench litters.....	4
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Front dressing packets:	
1. Red (small).....	120
2. White (medium).....	100
3. Blue (large).....	30
Total.....	250
Blankets.....	25
Hot-water bottles.....	6
Burners—blue flame Primus type, at least.....	1
(Oil for same.)	
Tea, chocolate, and sugar.	
Antitetanic serum (500 syringes), units each.....	1, 500

(B) The advanced aid post: Under the direction of each battalion surgeon, when necessary, there will be established for each company of Infantry and each battery of Artillery, an advanced aid post to which enlisted men of the Medical Corps will be assigned. These Medical Corps men will have been trained in the speedy and efficient application of splints and in the use of the ordinary stretcher and the trench litter. It is their duty to apply splints in a proper manner to the wounded man where he falls, and to transport him as speedily as possible to the battalion aid post for further treatment by the battalion surgeon. These men will carry forward to the post of the company or battery the following list of supplies. This list should be varied in amount to meet the military situation:

Thomas half-ring thigh and leg splints (B. K.).....	4
Thomas arm splint (hinged) Murray's modification.....	2
Cabot posterior wire leg splint.....	4
Ladder splints.....	12
Wire gauze (rolls).....	6
Light splint wood (3-foot and 4-foot lengths).....	2
Triangular slings.....	24
Cotton (batting-wadding) rolls.....	10
Muslin bandages.....	12
Zinc oxide adhesive plaster (2-inch rolls).....	1
Straps and buckles (2 sizes).....	12
Trench litters.....	2

(c) Ambulance dressing station: The director of ambulance companies will establish in the rear of the battalion aid posts stations which are known as ambulance dressing stations and represent the point to which ambulances may go forward for the evacuation of the wounded. A surgeon of the ambulance company will be in command of each post, and under his direction there will be assigned a certain number of the personnel of an ambulance company. This station is placed in a position convenient for the collection of the wounded, and here the wounded will be loaded into the ambulances after the ambulance surgeon has

passed upon their condition. The ambulance surgeon will supervise the readjustment of splints and dressings and the treatment of surgical shock. Wounded in a condition of shock should be held at this point and treatment given before they are subjected to the additional strain of an ambulance journey. Rapid evacuation of the wounded to that point where definitive treatment may be instituted is necessary and desirable and should be insisted upon, but nothing is gained by evacuating a man whose condition is such that further movement will be attended by grave risk of life. An hour or two of warmth and rest works wonders with such cases and frequently makes it possible to tide them over the critical stage so that they may be evacuated with safety. At the ambulance dressing station the following list of splints and supplies will be maintained:

Thomas half-ring thigh and leg splints (B. K.)	10
Thomas arm splint (hinged) Murray's modification	10
Cabot posterior wire leg splint	10
Ladder splints	25
Wire gauze (rolls)	15
Light splint wood (3-foot and 4-foot lengths)	10
Long Liston splints	1
Litter bars	10
Triangular slings	50
Cotton (batting-wadding) rolls	50
Muslin bandages	25
Zinc oxide adhesive plaster:	
Foot and 5-yard rolls	2
2-inch rolls	12
Straps and buckles (2 sizes)	20
Wire leg rests (for Thomas splints)	25
Front dressing packets:	
1. Red (small)	100
2. White (medium)	100
3. Blue (large)	100
Total	300
Blankets (extra)	50
Hot-water bottles	12
Burners (blue flame, Primus type), at least 3.	
Oil for same.	
Acetylene lamp	1
Carbide for same	pounds 6
Tea, chocolate and sugar.	
Antitetanic serum:	
Syringes	100
Units	1, 500

(d) The ambulance company: The ambulance company will hold in reserve at its headquarters the following list of supplies, as a reserve that can be immediately drawn upon from any particular area in case of necessity.

Thomas half-ring thigh and leg splints (B. K.)	60
Thomas arm splint (hinged) Murray's modification	40
Cabot posterior wire leg splint	50
Ladder splints	100
Wire gauze (rolls)	50
Wire splint wood (3-foot and 4-foot lengths)	50
Long Liston splints	2
Litter bars	25
Triangular slings	200
Cotton (batting-wadding) rolls	200
Muslin bandages	100

Zinc oxide adhesive plaster:	
Foot and 5-yard rolls	12
2-inch rolls	36
Straps and buckles (2 sizes)	50
Wire leg rests (for Thomas splints)	75

(E) Ambulances: Each ambulance will carry the following list of supplies:

Ford ambulance:

Litters	2
Blankets	6
Arm splints (Thomas)	1
Leg splints (Thomas B. K.)	1
Litter bars	1
Hot-water bags	3
Dressing packets (red, white, and blue), each	1
Cabot splints	1
Ladder splints	2
Triangular sling	6
Bandages	12

G. M. C. ambulance:

Litters	4
Blankets	12
Arm splints (Thomas)	1
Leg splints (Thomas B. K.)	1
Cabot splints	1
Litter bars	2
Hot-water bags	3
Shell dressings:	
Large	6
Small	6
Bandages (3 sizes)	24
Ladder splints	4
Triangular slings	6

(a) When a wounded man is placed in an ambulance, the ambulance orderly will replace from his supplies such articles as have been supplied the patient and will, in turn, obtain a duplicate from the hospital, to which the patient is delivered.

(b) In addition to the above list, each ambulance will carry four extra gas masks, French type, for use in case of emergency. These masks will not be used for exchange.

(c) In each ambulance a printed list as above will be posted.

(F) The field hospital: The functions of the field hospital will vary according to the need of the military situation. Each field hospital will hold in its supplies the following list of splints and splint accessories.

Thomas half-ring thigh and leg splints (B. K.)	10
Thomas arm splint (hinged), Murray's modification	10
Cabot posterior wire leg splints	20
Jones humerus traction splint, (right and left)	12
Ladder splints	25
Thomas traction arm splint	10
Wire gauze (rolls)	25
Light splint wood (3-foot and 4-foot lengths)	10
Long Liston splints	2
Jones cock-up splints	10
Sinclair blue	kilo ½
Litter bars	25
Triangular slings	160
Cotton (batting-wadding) rolls	200
Muslin bandages	100
Zinc oxide adhesive plaster:	
Foot and 5-yard rolls	10
2-inch rolls	12
Supporting slings (3 sizes)	100
Straps and buckles (2 sizes)	50
Paper clips	250
Wire leg rests (for Thomas splints)	50
Trench litter	0

(g) The noncombatant units: Each noncombat unit in a division will have the following supplies in splints and dressings for accident and emergency use:

Thomas half-ring thigh and leg splints (B. K.).....	4
Thomas arm splints (hinged), Murray's modification.....	2
Cabot posterior wire leg splint.....	4
Ladder splints.....	12
Wire gauze (rolls).....	5
Light splint wood (3-foot and 4-foot lengths).....	2
Litter bars.....	2
Triangular slings.....	24
Cotton (batting-wadding) rolls.....	10
Muslin bandages.....	12
Zinc oxide adhesive plaster:	
Foot and 5-yard rolls.....	1
2-inch rolls.....	6
Straps and buckles (2 sizes).....	12

3. *Litter bearers for a combat division in the field.*—A combat division in the field consists of 4 regiments of Infantry, 3 regiments of Artillery, and various trains and attached troops. The entire medical personnel is 1,250 enlisted men. There are 48 Medical Corps men attached to each regiment of Infantry, which allows 14 per battalion. These men because of their training should be used primarily as dressers and not be engaged in litter bearing, except under special conditions. The assignment of two or three men per company to care for the wounded and for general sanitary work, their station being the advance aid post with the company in the line, places them in a most useful position for doing effective work. The remaining 6 men should be stationed at the battalion aid post with the battalion medical officer, or distributed as conditions demand.

For litter bearers there are available from the ambulance companies of the division about 300 men. The bandsmen of the division may be used, though this is undesirable for reasons that are obvious; if used, not more than 100 are usually available, giving a total of 400 men for litter bearers. This number is not sufficient to meet the demands of evacuation in times of stress, which is a condition which may arise at any part of the line at any moment. To provide a sufficient working personnel and to maintain an adequate reserve it is necessary to have assigned from the combat troops men who shall be trained by medical officers in first aid, application of splints, and litter bearing to supplement the medical personnel in stress. These men should be used for evacuating the wounded from the front line to the battalion aid post under the direction of the Medical Corps men attached to companies. The use of such "company litter bearers" has two distinct advantages in that they have a personal interest in the wounded of their own organization and are familiar with the terrain over which the evacuation occurs.

The detailing of 8 men from each rifle and machine-gun company for this purpose would furnish about 700 additional bearers. It is necessary in considering such an assignment that these men be placed definitely under the control of the regimental surgeon when called upon for such duty so that he may direct their activity to the best advantage.

The following order is suggested as covering the instruction of this additional supply of litter bearers:

HEADQUARTERS——— DIVISION,
OFFICE OF THE SURGEON, A. E. F.

Memorandum: To surgeons of all organizations:

1. Attention is invited to memorandum from headquarters, —— Division, dated 1916, relative to training of eight men from each rifle and machine-gun company in first aid to the wounded, application of splints, and litter bearing. This is most important, in order to secure a reserve of trained men for use in case of emergency. Surgeons will be held responsible for the training of these men. They will also take the necessary steps to secure their services, when the number of casualties becomes greater than the Medical Department personnel, with the unit, can properly care for and evacuate.

Lieutenant Colonel, Medical Corps, United States Army,
Division Surgeon.

4. *Splint application*.—Regimental, battalion, and ambulance company surgeons will be responsible for the instruction of the Medical Corps personnel under their direction in the proper application of splints and dressings to the wounded. The application of traction to fractures of the long bones is necessary both to save life and to prevent shock. The Thomas half-ring thigh and leg splint (Blake-Keller) should be applied to all fractures of the lower extremity, from the pelvis to the ankle. In fractures of the leg so low down that extension can not be applied and in wounds of the bones and joints of ankle and foot, the Cabot posterior wire leg splint should be used, with such additional ladder or wood splints as may be necessary to secure adequate splinting. The methods of applying traction are simple and can be carried out quickly in the field. The Thomas arm splint (hinged), Murray's modification, should be applied to all fractures of the humerus, using adhesive plaster strips to secure the proper amount of traction. The Cabot posterior wire splint, wire ladder splint material, and splint wood should be used for the protection of wounds of the joints, laceration of the soft parts, and fractures involving the ankle joint and wrist.

The experience of the past four years has shown that traction is the most efficient method of splinting fractures. When the wounded man must be transported for some distance by litter and ambulance, it is particularly valuable, and its use has reduced the mortality in fractures of the femur to a small per cent of what it was before this form of splinting was generally adopted. In the application of the Thomas leg and arm splints, it must always be borne in mind that traction is the essential feature and that the efficiency of these splints is entirely dependent upon getting a sufficient amount of traction to secure fixation of the fragments. Additional supports, as slings, etc., used are but aids to the essential feature which is traction.

NOTE.—It is important that no prolonged attempt should be made to make a diagnosis of fracture. It is better in the field to splint all cases where fracture is probable rather than to waste time and further shock the patient trying to discover the exact nature and location of a possible fracture. In this connection experience has shown that in large wounds of the soft parts without fracture the use of splints has been a material aid in reducing hemorrhage and increasing the comfort of the wounded during transportation, thus reducing shock.

The trench litter, known as the snowshoe litter, is a device found very useful for the evacuation of wounded in the first carry; i. e., from the place where the man is hit to the battalion aid post. On this litter the wounded man can be stood upright, turned sideways, or face downward without discomfort to him; thus aiding in the difficult carry through a trench. When the wounded man has reached the battalion aid post, he can ordinarily be placed on the common type of litter, his splints readjusted, his wounds properly dressed, and his fractured extremity suspended in the splint from the litter bar.

The litter bar should be used as soon as the patient is placed on all ordinary litters, and from it the splint should be suspended. This is necessary when the Thomas splint is used in order that the litter may be placed inside the ambulance.

5. *Shock and hemorrhage*.—The zone through which a wounded man must pass from the time he is wounded until he reaches a hospital may be called the zone of shock and hemorrhage. Shock as the result of hemorrhage, exposure, and pain is the most serious immediate complication of severe wounds; it is of common occurrence in wounds with fractures of the large bones. To combat shock the application of heat in every available form and in fractures adequate splinting are our most valuable aids. In all battalion aid posts and ambulance dressing stations the following memoranda should be posted:

THE PREVENTION AND EARLY TREATMENT OF WOUND SHOCK AT THE BATTALION AID POST OR
AMBULANCE DRESSING STATION

Consider the general condition of the wounded man first and tend his wound second.

Keep one dry stretcher with three dry blankets always in readiness.

Give wounded man a hot drink, with a tablespoonful of sodium bicarbonate dissolved in it as soon as he arrives.

Remove wet boots and leggings and any clothing that covers his wounds. Transfer him to dry stretcher, folding two blankets on stretcher so that he lies on four folds of blankets and the ends fall over sides of stretcher rack forming an air chamber; the Primus or Beatrice stoves for heat.

When wounded man is well warmed and quieted, dress wounds and apply splints properly for ambulance trip. Place well-guarded hot-water bottles in each axilla and one across loins.

Turn the blanket ends which hang down over the sides of the stretcher over the patient after a doubled blanket has been laid over him, and tuck the ends well in.

Finally just before the patient is sent out give him another hot drink.

It is important above all that efficient traction and support be applied to all fractures of the long bones.

Antitetanic serum should be administered at the battalion aid post.

An attitude of cheerfulness and encouragement is of great importance.

DON'TS

Don't annoy, delay, nag, and further injure by taking off shoes or clothing in the front area.

Don't forget to throw Thomas splints as far forward as the soldier goes.

Don't forget that there is a man as well as a wound; the man may be killed while the wound is being cured.

Don't forget that the bottom of the stretcher needs blankets more than the top of the man.

Don't forget the value of reassurance.

Don't give stimulants—the patient is not in need of stimulants, for the battle is a stimulant; the whistling and bursting shell is a stimulant; the shattered bone is a stimulant; in other words,

Don't give the soldier an overdose of the thing which is killing him.

THE FOLLOWING POINTS ARE EMPHASIZED

(1) Surgical operations are prohibited except in a hospital. Treatment at the front and during evacuation to the hospital will be limited to first aid, splints, control of hemorrhage, and shock. Probing for bullets or fragments of any sort is expressly forbidden.

(2) Every effort will be made to secure delivery of the patient to the proper hospital at the earliest possible moment after receipt of the injury. Saving of time during the early period of the injury may mean life or death of the patient.

(3) During the evacuation of the patient, he must be kept as comfortable as it is possible. He must be disturbed as little as possible, and in any event, after the first dressings and splints are applied only so much as is necessary to see that the dressings, splints, etc., have been properly applied and continue in good shape.

(4) Warmth will be continuously applied. This is our best preventive for shock. It will be secured by hot-water bags, alcohol or oil stoves, hot bottles, etc.

(5) A constant flow of supplies will be kept up from the rear to the front lines by a system of exchange noted above.

Army Sanitary School No. 121.

BACTERIA OF WAR WOUNDS

By M. Magrou, of the Institute Pasteur

Infection of wounds.—War wounds may be said to always contain bacteria. Bacteria come into the wound at the very moment that the wound is made. They are conveyed by the projectile itself, but chiefly by foreign bodies carried with it (pieces of clothing, dirt, etc.). It is well known also that there exist, on the surface of the skin and in the hair follicles, numerous organisms which may, subsequently, invade wounds. With few exceptions bacteria penetrating into wounds in this way are incapable of development in living tissues; they can, on the other hand, live in necrotic tissues, wherein they multiply as in culture media. These bacteria find very favorable conditions in wounds. Muscular attrition brought about by the traumatism invites sepsis of more or less extended areas. Vascular lesions and ischemia, which follow them, act in a like manner. In the zone of necrosis thus constituted, several types of bacterial flora may begin to develop; these organisms, while develop-

ing, produce chemical modifications in their medium, which render the latter favorable to the propagation of other types. Thus, certain microorganisms prepare the soil for others; therefore microbic associations play a preponderant rôle in the bacteriology of war wounds. This explains why types that multiply in wounds are not the same at all the different evolutionary stages of the wound; there takes place in the wound an evolution of the bacterial flora the general habits of which it is easy for us to make out.

General evolution of the flora of wounds.—In a general manner, wounds will appear contaminated from the first. Observations conducted during the first few hours immediately following the production of the wound reveal the existence of a small number of bacteria belonging, usually, to common saprophytic groups (*Staphylococcus albus*, *B. anthracoides*, *B. cutis*, *i. e.*). Later on, between the eleventh and twelfth hours, as a rule, anaerobic bacteria will begin to multiply in remarkable numbers, so that at the end of the first or second day they make up the whole or the major part of the wound flora. In the days following, the anaerobic flora decrease and finally disappear, save in cases where they find particularly favorable conditions for their development. (Notably, should an incomplete surgical operation have left a number of necrotic foci.) Aerobic types, among them the pyogenic microbes, such as staphylococcus and streptococcus, assume a preponderating influence, which afterwards becomes complete. We have given only extremely general rules which admit of many exceptions.

Classification.—After expounding the foregoing general principles, we shall review the most common bacterial species to be found in war wounds.

(1) Direct examination of stained smears, of pathologic products (pus or serum) taken from the wound, gives an idea of the number and nature of organisms contained therein. However, data furnished through this process are incomplete; precise determination can only be obtained from culture. Any bacteriological examination of the suspected material includes aerobic culture (on peptone agar) and anaerobic (on Veillon agar). For special cases, certain special technique may be more suitable, especially, as will be seen later, for the rapid determination of streptococcus.

Wound bacteria may be divided into several groups. We shall consider successively: Spore-bearing bacilli; Gram-negative bacilli; Gram-positive micrococci; branching bacteria.

I. SPORE-BEARING BACILLI

General characteristics.—Spore-bearing bacilli form a well-defined natural group; small rods, Gram-positive with reproduction by endospores. In regard to these there are two fundamental peculiarities of the group: (1) Their ability to "take up the Gram" may be very fugacious; (2) not all culture media are favorable in the same degree to the production of spores; it is in poor media, generally, that they are most easily obtained.

Endospores multiply as follows: A portion of the bacterial protoplasm becomes condensed at a certain point in the bacillus. A thick refracting membrane, difficult to stain, appears around the condensed protoplasm. In some species, the spore formed as described is just as broad as the mother bacillus. In other species it grows broader than the mother cell; the latter becoming deformed thereby, with its contour swollen at that point. In this case, the spore may occupy a central or a subterminal position (clostridium), or terminal, which gives the new bacillus the aspect of a pin or drumstick (*paraplectrum* or *plectridium*).

Spore-bearing anaerobic bacilli.—Among the spore-bearing bacilli, some are anaerobic, others aerobic. Spore-bearing anaerobic bacilli are among the most important genera found in wounds; the organisms causing gas gangrene belong to this group. Some are motionless; others are mobile.

Bacillus perfringens.—The type of immobile anaerobes is the *Bacillus perfringens* Veillon (*B. aerogenes*), *capsulatus* Welch, *B. de Frankel*). It appears in the form of straight rods, thick, squat, immobile, capsulated, Gram-positive, usually isolated or in pairs, not forming long chains. Spores are median or subterminal; they never multiply in sugar media. Colonies

in Veillon's agar^a are lenticular, with regular outline, sometimes adopting the shape of a heart; their growth is accompanied with an abundant production of gas, which breaks up the agar. Bouillon cultures are uniformly turbid at first, but clear up later, leaving a sediment.

The isolation of anaerobes in Veillon agar is accomplished as follows: A number of Veillon tubes are boiled in a water bath for 15 minutes, so as to expel the air contained in the agar. They are then cooled down to 42° to 45°, after this the substance to be examined (pus or serum, for instance) is taken on a platinum loop and sown in one of the tubes. Then, with the same loop, a drop of the first tube is sown in the second, the third from the second, etc. We obtain from the first tube numerous colonies, but in the subsequent tubes they are sparse and well isolated.

B. perfringens coagulates milk and gives a spongy clot; it digests boiled-egg albumin very slowly.

B. perfringens is one of the most common microorganisms in war wounds. It is the most frequent cause of gas gangrene, but it becomes dangerous only when favored by its surroundings. If an early and complete surgical operation has excised the dead tissues, and if the *B. perfringens* is not associated with the aerobes, notably with staphylococcus, and more especially with streptococcus, it always disappears from the wound which contains it. Sometimes wounds containing only *B. perfringens* can be observed to heal perfectly after primary suture.

Septic vibron and related species.—The type of mobile anaerobic bacilla is the septic vibron, discovered by Pasteur (*B. oedematis maligni* Flugge). It is a more slender rod than the *B. perfringens*, generally rather long, straight or bent, mobile, and ciliated. They are unassociated or form long chains of bacilli, joined endwise. Spores are median, sometimes subterminal; they are broader than the body of the bacillus, which becomes swollen at the point where they are developed (*clostridium* form). Colonies in Veillon agar are cloudy, finely hairy, with the appearance of a felting made of fine, wavy filaments. This last characteristic is not permanent, for the septic vibron has been observed to produce lenticular or cordlike colonies. Bouillon cultures produce a putrid odor and the medium is at first uniformly turbid. These cultures eventually clear up, leaving a deposit. The septic vibron is specifically agglutinated by the septic and antivibron serum.

Less frequent in wounds than the *B. perfringens*, the septic vibron has been observed in a number of serious cases of gas gangrene.

To the septic vibron type are related several types presenting morphological similarity. These types differing from the septic vibron "sensu stricto" differ also from each other in their pathogenic properties and in the strictly specific action of corresponding antitoxins or agglutinins. Of this number is the *Bacillus sporogenes* Metchnikoff, formerly described among intestinal flora and since rediscovered in war wounds. This organism generally appears in spherical, opaque colonies, covered with short hairs, giving it the appearance of a ball of wool. To the same group belong some species discovered since the outbreak of the war in different cases of gas gangrene: *Bacillus bellonensis* Saequepée; *Bacillus oedematiens*, Weinberg and Seguin, which produces a very active toxin; *Bacillus histolyticus*, whose characteristic is the rapid liquefaction of tissues invaded.

Lastly, another anaerobe belonging also to the intestinal flora is to be found in war wounds: *Bacillus putrificus*. It is a straight rod, very mobile, ciliated, Gram-positive. Its spores are either terminal (*paraplectrum*, Bienstock type) or median, or subterminal (Metchnikoff type). Colonies in agar are formed of a central nucleus surrounded by numerous filaments. Egg albumin, coagulated, is readily digested. Cultures in different media give a distinct putrid odor.

Spore-bearing aerobic bacilli.—Spore-bearing aerobic bacilli found in war wounds are far less important than the anaerobes of the same group. They are saprophytic bacteria and are innocuous. They are also classified as mobile and nonmobile.

^a Veillon's agar: Ordinary peptonized agar, 1,000 gm.; glucose, 15 gm.; potassium nitrate, 1 gm., to be put into deep tubes filling up about half of their depth. In this medium, glucose acts as a reducer; it prevents oxygen from getting to the depths of the agar as thus anaerobes are enabled to thrive. After the tube has been inoculated, there remains in the upper portion of the agar a zone (more or less extended according to the exigency of the anaerobe) wherein microbes do not live. Potassium nitrate is added to the medium with the object of absorbing the greater part of the gases which the culture gives rise to.

Nonmobile bacilli are represented by the *Bacillus anthracoides*, which is one of the most common bacteria of war wounds. By its morphological characteristics it is related to the bacillus of anthrax (*B. anthracis*); it differs in its lack of pathogenicity. It is a large Gram-positive bacillus, with median spores. It is often seen in chains, but not always. Colonies in agar are round, flat, dull-whitish and gelatin is liquefied.

Among the aerobic spore-bearing bacilli, which are mobile, we may mention the *B. mesentericus*, whose colonies are convoluted. The *B. mycoides* produce colonies with hazy edges; they spread by delicate flexuous prolongations.

B. subtilis is also seen, on whose whitish colonies fine clear drops are noted. This bacillus, widely spread in nature, is only exceptionally encountered in wounds.

Finally, there is a terminal spore bacillus (*paraplectrum*) not often seen, giving on agar, round, flat, transparent colonies.

Branching bacilli: Gram-positive, non-spore-bearing bacilli will be studied with the streptothrices (streptothrix) to which they are similar on account of their power to ramify, which they possess to an unusual degree.

II. GRAM-NEGATIVE BACILLI

Gram-negative bacilli can be classified as mobile and nonmobile, as in the spore-bearing bacilli. Mobile bacilli of this group are subdivided, according to their reaction on protein, into two new groups: Those which liquefy gelatin and coagulate serum and those which liquefy neither one or the other.

Bacillus proteus.—Gram-negative, gelatinolytic and proteolytic bacilli are represented in wounds by the *B. proteus* and the *B. pyocyaneus*. *B. proteus* is a very mobile, ciliated bacillus. On agar it gives rapidly spreading colonies, forming a thin iridescent veil and producing a fetid odor. It is a facultative anaerobe.

Bacillus pyocyaneus.—*B. proteus* is a common inhabitant of war wounds, generally found in a relatively late period of their evolution. Such is also the case with *B. pyocyaneus*. This organism, mobile and provided with a single terminal cilium, is characterized by the production of two pigments which diffuse throughout the culture media; a blue pigment, pyocyanin, and a fluorescent green one. Either one or both pigments may be lacking, but it is easy to cause them to reappear by cultivating the organism in an appropriate medium.

(NOTE.—Gessard medium: Peptone, 2; glycerin, 5; agar, 5; in 100 parts of water.)

B. pyocyaneus, when a flourishing growth takes place, leads to the formation of a blue pus. Its pathogenic power, like that of *B. proteus*, practically amounts to nothing; consequently, its presence in a wound does not impede suture.

Bacillus coli.—Mobile, Gram-negative bacilli, liquefying neither gelatin nor serum, form the vast colon-typhoid group. Only one representative is found in war wounds, and this one is rare—*Bacillus coli*. It is ciliated, mobile, ferments lactose with the production of acids and gas; it produces indol in peptonized media.

Bacillus Friedlander.—Immobile, Gram-negative bacilli are represented in wounds by *B. Friedlander*. It is a capsulated bacillus, variable in form; its elements, more or less elongated, generally thick set, are often grouped in twos. Sometimes short and even perfectly round forms can be seen (micrococcus or diplococcus). Colonies in agar are porcelain white, raised, hemispheric, greasy, and stringy. Gelatin is not liquefied. Stab cultures in gelatin take the characteristic shape of a nail, with convex disk on the surface and a white prolongation along the track of inoculation. *B. Friedlander* is a facultative anaerobe; its development in Veillon agar is accompanied by the production of gas, sometimes abundant. It is commonly found in war wounds, but its presence does not seem to be productive of harm.

III. GRAM-POSITIVE MICROCOCCI

The group of Gram-positive micrococci includes war wounds aerobes of greater importance. Two subgroups may be differentiated according to the mode of arrangements of the individual cells, chainlike or in bunches.

Chainlike micrococci comprise two closely related species entirely different in their pathogenic effects: Streptococci and enterococci.

Streptococcus.—In liquid media, it forms long chains, generally flexuous, or coiled up. In solid media, especially in pathogenic products, these chains are often short.

(NOTE.—Not rarely, streptococci presenting the aspect of diplococci can be seen in pus. In bouillon cultures flakes are formed that sink to the bottom of the tube where they make up a clotted deposit, without clouding the medium. Agar colonies are very fine, transparent acuminated, with slightly crenated edges; in agar media, to which albuminoid substances (serum of ascitic fluid) have been added, they retain the same aspect but are generally more luxuriantly developed. The streptococcus is an anaerobe facultative; certain races prosper better as anaerobes than as aerobes. In agar cultures, examination of the water of condensation shows the characteristic long chains.)

Finally, the streptococcus has a most important characteristic; it is generally hemolytic; cultures in bouillon containing washed red blood cells hemolyze the latter; hemoglobin thus released is secondarily attacked by the streptococcus and the liquid becomes thence of a tint resembling that of onion parings or old wine.

The genus streptococcus is subdivided into many species, whose differentiation depends mainly on their hemolytic properties. It is admitted generally that hemolytic streptococci are the most pathogenic; it is assumed that there exists correlation between the hemolytic power and the pathogenic activity of the coccus. Therefore it is important to ascertain whether a streptococcus isolated from a wound is or is not hemolytic.

The streptococcus has proved itself to be one of the most dangerous microbes of war wounds. In association with the anaerobes it favors their reproduction and, therefore, the appearance of serious accidents, i. e., gas gangrene. Furthermore, it is the only wound aerobe observed to cause general septicemia. Finally, when it effects a foot hold in a wound, it proves extremely tenacious, giving rise to protracted suppuration and sometimes constitutional affections as, for instance, sudden and violent fever, or even distant complications (arthritis, osteitis, empyema, etc.).

Hence the presence of streptococci is in itself the most important contraindication to the suture of the wound; so much so that it has been established as a general rule that sutured wounds in which bacteriological examination demonstrates the existence of this organism must be reopened immediately. As a matter of fact, in almost every unsuccessful primary suture, bacteriological examination has demonstrated that the streptococcus was concerned in the failure. Not all strains, however, seem to be equally virulent; in some cases, primary suture has been partially and even completely successful, in spite of the presence of the hemolytic streptococcus.

Be that as it may, it is of the utmost importance that the surgeon be informed as quickly as possible of the presence of true hemolytic streptococci in wounds. To accomplish this end it is recommended to inoculate liberally from all suspicious parts of the wound in bouillon, or, better yet, peptonized water, with glucose at 2 per 1,000 and an albuminous liquid ascitic fluid or egg albumen.

(NOTE.—For further details, see Weissenbach's technique, appended.)

In this medium, the development of the streptococcus is very rapid, so that it can be made out after 6 to 8 hours incubation and, indeed, often after 4 hours. If after this lapse of time the presence in the cultures of micrococci forming long chains is verified, it may be concluded that an organism of the streptococcus group exists in the wound.

(NOTE.—To examine, secure with a pipette from the bottom of the test tube a drop of the culture, stain by Gram and also make an examination of the unstained, unfixed organism in a hanging drop, thus preventing the disassociation of the little chains.)

It suffices to transplant the culture to a blood medium (preferably blood agar plates in order to obtain isolated colonies) to be able to judge if the strain found is hemolytic or not.

Enterococcus.—This organism, very common in war wounds, appears like the streptococcus in the form of Gram-positive micrococci arranged in chains; but the chains are short, some quite short, and diplococci forms are frequent. Besides, individual cells are generally more elongated. Bouillon cultures are uniformly turbid; secondarily, a stringy deposit appears in the shape of a gimlet, rising through the liquid when the test tube is shaken. The culture medium does not present the clotted aspect of the deposit left by the true streptococcus. Colonies on agar are fine, but somewhat larger than those of the streptococcus; they are milky in color, evenly rounded and not acuminated. The enterococcus is not hemolytic.

This organism, unlike the streptococcus, has no bad effect on the evolution of war wounds.

Gram-positive, irregular, clusterlike micrococci are comprised under the name staphylococci. The *Sarcina* form geometric clusters.

The staphylococcus.—Staphylococci form irregular clusters, more or less voluminous, resembling bunches of grapes. Diplococcus and tetrad forms occur in pus. According to the color of the colonies, three species of the staphylococcus are recognizable.

The white staphylococcus (*Staphylococcus albus*) gives pigmentless, porcelain-white colonies. It does not liquefy gelatin. Its pathogenic power is more often weak or nil. To this species may be related several other species of lesser importance as yet not well defined (*Micrococcus candidus*, *Micrococcus*). It is useless to describe them, as they are not pathogenic.

The "gilded" staphylococcus (*Staphylococcus aureus*) occurs more frequently and is of greater importance. Its colonies are at first grayish; thence they become a more or less intense golden yellow color, especially if the test tubes are kept at ordinary temperature. Certain races are only feebly pigmented and must not be mistaken for the white staphylococcus. Gelatin is liquefied in a funnel shape. The staphylococcus may live as an anaerobe, but its growth is favored by oxygen.

The occurrence of *Staphylococcus aureus* in war wounds may cause several phenomena:

(1) In association with anaerobes it favors their development, although to a lesser degree than the streptococcus.

(2) Locally it often brings about suppuration.

(3) Sometimes distant localizations take place (arthritis, osteomyelitis) which may become tenacious.

When they invade tissue deeply, as demonstrated by Masson, the colonies may be encysted, forming grains or nodules like those of the *Botryomycosis equinus*.

However, the presence of staphylococcus, when it is not abundant and not associated with anaerobes, is not a sufficient reason to prohibit the suture of wounds.

Sarcina.—Sarcinae are Gram-positive micrococci arranged in regular cubic clusters. Such arrangement is the result of the mode of their reproduction; one sarcina, through three successive mitoses in the three dimensions of space, gives eight coherent cells; through sequences of the same process, more or less voluminous cubic clusters are found in the shape of bales of cotton.

(NOTE.—This arrangement is better seen in liquid culture media or in the water of condensation of agar cultures.)

Several species of sarcina have been differentiated according to the color of the colonies. White sarcina (*Sarcina alba*), yellow sarcina (*Sarcina lutea*), pink sarcina (*Sarcina cornea*).

When found in wounds, sarcinae are not abundant; they are saprophytes, having no pathogenicity whatsoever.

IV. RAMIFIED BACTERIA

We shall include in this group bacteria only exceptionally producing branches and bacteria ordinarily branched.

Corynebacterium.—Bacteria, exceptionally branched, look ordinarily like bacilli. They have been grouped under the name Corynebacterium, type of the *Bacillus diphtheria*. They are Gram-positive bacilli, irregular in shape, often bent, nail-shaped, or beaded; generally grouped by twos (V-shape), or forming palisades or thornlike clusters.

A representative of this genus is frequently found in wounds, *Bacillus* (*Corynebacterium*) *cutis*, a normal inhabitant of the skin. It has the appearance of cuneiform rods, hardly any longer than broad, resembling the short diphtheria bacillus. In certain strains, however, individual cells are more elongated, approaching the medium and long varieties of the *Bacillus diphtheria*. It is very simple to recognize the *B. cutis*, which is strictly aerobic; the *Bacillus diphtheria* is a facultative anaerobe. Culture in Veillon agar makes it easy to distinguish this difference. *B. cutis* only multiplies on the surface or in the upper layers of the agar, while the diphtheria bacillus produces its colonies throughout the whole medium. *B. cutis* is not pathogenic.

A few cases of infection of wounds by the diphtheria bacillus have been reported. This organism, when it invades the wounds, gives rise to the local formation of false membranes; at the same time, general symptoms of more or less serious toxemia appear which yield to subcutaneous injections of diphtheria antitoxin, while the local development of the bacillus can be stopped by applying specific antitoxin serum on the wound.

Streptothrix.—Normally branched bacteria makes up the streptothrix group, which many authors consign to the fungi *imperfecti*. But the cytologic coloring of these organisms never reveals in the interior of their filaments the presence of definite nuclei such as exist in all fungi. This characteristic suffices to classify them still among the bacteria.

The streptothrices, which include the organisms of actinomycosis, have only one representative in the flora of wounds, *Nocardia dassonvillei*. This organism is composed of slender filaments, Gram-positive, branched, and complex; it is reduced to débris (arthrospores) in old cultures. Colonies on agar are very hard and at first cream colored. They become covered secondarily with a white "pruine," which gives them the appearance of fresh plaster blocks. Cultures produce an intense musty odor. *Nocardia dassonvillei* is only accidentally found in war wounds; it has no pathogenic significance.

The following table sums up the main characteristics of the most common wound bacteria. To facilitate the reading, the species have been grouped according to the system of dichotomic keys.

I. Endospores:

Anaerobes—

Mobile—

- B. Sporogenes.*
- B. Putrificus.*
- B. Bellonensis.*
- B. Oedamiens mal.*
- B. Histolyticus.*
- Vibrio septique.*

Nonmobile—*B. Perfringens.*

Aerobes—

Nonmobile—*B. Anthracoides.*

Mobile—

- B. Mesentericus.*
- B. Mucoides.*
- B. Subtilis.*

II. Non spore:

Gram-positive—

- B. eutis* of pseudo-diphtheria—a true aerobe.
- B. diphtheria*, a facultative anaerobe.

Gram-negative.

(a) Those which liquefy gelatin—

- B. proteus*, foul odor.
- B. pyocyaneus*, blue or green color.

(b) Those which do not liquefy gelatin—*B. coli*.

III. Micrococci:

(a) Growing in chains—

- Streptococcus.*
- Enterococcus.*

(b) Grow in groups—

(1) *Staphylococcus*—

- Irregular.
- Albus.
- Aureus.
- Citrus.

(2) *Sarcina*, regular.

IV. Streptothrices (fungi?).

V. *Nocardia* (fungi?).

APPENDIX

Culture in peptonized glucose water containing alkaline, egg albumen. A special method for rapid and certain definition of streptococci in war wounds containing a varied bacterial flora. By R. J. Weissenbach.

I. PREPARATION OF CULTURE MEDIUM

The two following solutions must be prepared separately.

1. *Peptonized glucose water*.—Water, 100 c. c.; Pepton Chapoteaut, 4 gm.; salt, 0.50 gm. Neutralize, or, better, render slightly alkaline to litmus; subject to 15 minutes in autoclave at 120° temperature, then filter and add to 100 c. c., glucose, 0.20 gm. (It is not necessary to use chemically pure glucose.)

2. *Alkaline egg albumin*.—Mix: Egg albumin, 1 part; distilled water, 3 parts. Two whites of eggs from 200 to 250 c. c. of mixture. Mix and shake in a large cup. Add 0.50 c. c. of soda solution (10 per cent) to 100 c. c. of the water and albumin mixture. Keep in autoclave 15 minutes at 115° to precipitate. Filter while warm.

Mix the two preceding solutions: Peptonized glucose water, 50 c. c.; alkaline egg albumin, 50 c. c. Distribute in test tubes, 5 c. c. to a tube. Sterilize in autoclave 15 minutes at 110°.

II. INOCULATION

The quantity of pus or exudate to be inoculated should be relatively considerable, grossly approximating one-twentieth to one-tenth cubic centimeter of a properly collected specimen containing from 20 to 40 cocci per microscopic field (oil immersion, objective one-twelfth—compensation ocular 4) and in this smears. After the inoculation, shake the test tube to obtain a uniform mixture. Then place in autoclave at 37° to 38°. If the result must be known as early as possible (primary suture), the culture must be tested successively after 4, 6, and 8 hours. In other cases (secondary suture) it suffices to test it once between the eighth and tenth hours for the development of other organisms may render the discovery of streptococci very difficult. Should this single test prove negative, proceed to make another between the eighteenth and twenty-fourth hours, only as a control. Practically, according to the nature of the specimen in which inoculation is performed, the result is obtained, in half the cases, after 6 hours at 37°, in one-fourth of the cases after 4 hours; and in the remaining fourth after 8 hours.

Examination of the culture should be carried out as follows:

Without shaking the tube, get from the bottom of it, with a capillary pipette, a small quantity of liquid containing the pus globules sedimented during the time they remained in the incubator; the most numerous and most characteristic chains will be found in these cells at least during the first few hours.

A drop of the culture medium, obtained under these conditions, is placed on a slide, covered with a cover glass, and examined directly without staining, with a strong dry objective. These are the best conditions to observe the long sinuous chains of 30 or 40 cocci or the more voluminous clusters out of which spring the chains; such is the appearance of the streptococcus as it occurs in this culture medium. Another drop is transferred to the slide and stained by the Gram method for the study of the morphological character of the cocci. The chains appear more disunited, shorter, and therefore less characteristic than in the preceding preparation. It is imperative to make, each time, this double examination.

The development of the other associated bacteria, not very active as a rule, but variable according to their relative number and nature, is not confusing. This method causes less errors than any other.

As soon as direct examination has revealed in the medium the presence of Gram-positive chainlike micrococci, which suggests the existence of streptococci, a new inoculation is conducted on blood agar in order to obtain isolated colonies which will permit us to identify them and also to bring out their hemolytic properties. Two 10 c. c. test tubes containing ordinary liquefied agar kept at 45°, each receive 1 c. c. of defibrinated or citrated (human blood). One platinum loop is taken from the culture medium containing micrococci; the contents of the loop are distributed in the liquid in the first tube of blood agar. Then, without refilling the

loop, the same procedure is carried out with the second tube of blood agar; the contents of each tube are powdered into a Petri dish. After solidification it is taken to the incubator (37° to 38°). At the end of 12 to 18 hours, if there exist hemolytic streptococci, we will find very small colonies surrounded with a yellowish white halo of hemoglobinolysis of $\frac{1}{2}$, then 1, and later 2 mm. in diameter. These colonies differ from other isolated hemolytic bacteria of wounds; nevertheless, its nature must be always verified by examination of stained smears (Gram method). These isolated colonies will serve as a starting point for the study of the other differential biochemic characters needed for a valid identification of bacteria.

Army Sanitary School No. 122.

CONVALESCENT CAMPS

By Col. Bailey K. Ashford, M. C., commandant, Field Service School for Medical Officers, A. E. F.

There are at least four features in the work of the medical corps of an army to-day which have recently placed medical officers in the position of being among the most active of the forces with which the enemy has to count, for by its medical corps an army can to a large extent delay and repair the ravages of war in men lost to the fighting line; in other words, the medical corps of an army has ceased to be a corps of doctors pure and simple, appendages of an army and noncombatant in every sense as far as war goes, who employ their profession to alleviate pain and repair the damaged individual. To-day they constitute the most valuable of all salvage corps—the salvage corps for men, the only corps by which damaged men can be salvaged. Naturally these officers are rewarded for the application of the medical sciences to the art of war by being deliberately bombed, gassed, and shelled by an enemy who has not failed at all to realize the importance and value of their contribution. There are at least four outstanding factors in this new conception of the duties of a medical officer which make him willy-nilly an active participant in the winning of battles:

- (1) The prevention of disease by sanitary art and by preventive medicine;
- (2) The rapid collection and forwarding of the wounded and gassed, with intelligent first aid, such as the transportation of fractures in extension, the preventive treatment of shock, the immediate relief of the gassed, and the direct removal in the most comfortable and expeditious manner of all casualties to hospitals adequately provided to fulfill the requirements of modern military medicine and surgery;
- (3) The prevention of infection of wounds by the surgical removal of the contaminated dead and dying tissue upon which organisms have heretofore been able to thrive; and
- (4) The rapid return to duty, through convalescent camps, of men who heretofore have spent months in the zone of the interior, many never returning to the lines and being lost to the army.

It is with this last desideratum that we have to deal here.

The whole idea of a convalescent camp or depot is a point which the Medical Department operates to salvage men who would otherwise occupy a bed in a base hospital or be sent back to their homes or some watering place where the military spirit into which they have been inducted is more or less rapidly lost without any corresponding real benefit to their physique. The object is to get men away from base hospitals who will need no further active medical or surgical treatment, but merely medical surveillance, and who especially need to be brought back into a military atmosphere rather than be allowed to remain in a convalescent frame of mind. The two absolute essentials of a good convalescent camp are (1) that it should be commanded and administered by medical officers and (2) that it should be a place which should combine all the pleasanter features of military life and its comforts without supplying luxuries or permitting vices which tend to pamper the soldier and unfit him for his better return to the lines.

To show what can be done in this respect, Convalescent Camp No. 1, of the British has returned to the front direct 5,000 men in six months and Convalescent Hospital No. 10 about 1,500 per month. In general the statements from the convalescent depots and camps

seen to date make it clear that the time spent in convalescence by men at base hospitals has by means of these camps been reduced from nine months to one month in the 50 per cent of cases that are returned to duty at the front. These figures are approximate, but were given me by their commanding officers. Maj. Gen. C. H. Burchaell, now director of medical services, British Expeditionary Force, in France, stated that out of 1,015 men at a convalescent camp 756 were returned to duty cured as type A men, 127 remained as P. B., 123 were returned to base hospitals, and only 9 sent home to England.

In connection with the first essential of a good convalescent camp—that it should be run entirely by medical officers—it should be remembered that if such camps are placed in the hands of nonprofessional men, line officers, they will be looked upon as training areas, and these they are not. It should be remembered that they are points at which damaged men are salvaged, and damaged men can not be salvaged save by the scientific medical officer whose aim and ambition is to put as many able-bodied men back in the fighting line as soon as he can and whose military sense is developed *pari passu* with his specialty. Such men can not be salvaged by mere doctors nor by mere scientists, however well meaning they may be. This is the legitimate field of a well-trained officer of the Medical Corps who has really learned to apply his profession to the conditions of war.

THE GENERAL PLAN OF A CONVALESCENT CAMP

A convalescent camp should be carefully laid out and should be a barrack and not a tent affair. The site should be pleasant and healthful; above all it should be in the country away from all other centers, with plenty of room to expand. It should communicate by good roads with necessary centers, and should be laid out with a view to ornateness, with well-turfed lawns and abundant shade, with gardens and flowers, and with good walks, which should include surroundings that would be pleasing to the eye and which would lead into the open country. These camps should accommodate from 2,000 to 3,000 men, who should be divided into companies of 250 each, under the immediate charge of experienced noncommissioned officers. There should be regular hours for meals, and such formations as are decided upon should be observed with military exactness. Great care should be taken at these places to provide for the men all military comforts and necessities with a minimum amount of the annoying petty details of a soldier's life. For example, the barrack itself. This should be attractively painted, with stained floor and stained rafters; with kalsomined walls and ceiling. It is an enormous advantage to have the floors waxed, or at least oiled. Beds are by no means a necessity; a straw mattress with a sufficient number of blankets, and a set of hooks and shelves above each man's head for his clothing and equipment being quite sufficient, provided the barrack itself is spotlessly clean, neat, and attractive. The chill should be taken off the barrack by enough stoves, but the stuffy heat without ventilation too often seen in such barracks should be prevented. The men should sleep with the windows wide open. Both latrines and baths should be accessible, and these should be as clean and as decent as the sleeping quarters.

There should be at each one of these convalescent camps an excellent quartermaster storehouse, where an ample supply of clothing, field equipment, etc., should be kept at all times, so that no man need go dirty or slouchy, and every man when he goes away may be properly equipped to join his organization. There should be certain features about this quartermaster's storehouse that might be with benefit much more elaborate and detailed than in one of an ordinary depot type. Here considerable effort should be made to provide shoes for the men that will fit. This work, begun in times of peace in our country by our Medical Corps and with such success, finds a peculiarly important mission to perform at these convalescent camps. In connection with these storehouses there should be a set of shops which could be used for the employment of men in the army who have become partially disabled for front-line service—the so-called B men. Two such men should be permanently assigned here as tailors, and their shops should be used not only for the convenience of the men but for the instruction of certain convalescents who will probably be unable to return to the fighting lines and who may be advantageously placed in the lines of communication for the good of the Army when they are sufficiently trained. This same policy should apply to all other industrial shops, which should form a feature of a convalescent camp. Thus a

practical outcome of these camps will be a provision for training schools for artisans needed in the Army. There should be, therefore, cobblers, tinsmiths, electricians, carpenters, blacksmiths, leather workers, laundrymen, cooks, musicians for bands, and others trained here.

The bathing, disinfecting, and laundry systems should be unusually complete. In addition to the usual care taken to cleanse and disinfect the soldier upon his arrival, means should be provided to keep him clean and neat until he goes away. A delouser should be kept at this plant, which should be central and accessible, and the belongings of all men should be disinfested once a week. In addition to showers, it is well to afford other varieties of baths. For instance, we noted in some of the convalescent camps that cement baths had been sunk in the floor for about a foot, underneath the shower, and that these baths were curtained off and made individual; both hot and cold water was available. It is well to have, also, a room for a Turkish bath; but the men should be made to go in in groups to prevent accident, and a cool or temperate shower should be exacted of every man bathing thus before leaving the establishment. The baths should have attendants who are well versed in skin disease to pick out men who are lousy, who have the itch, or some other contagious disease of the skin. Fresh clothing should be freely supplied, as well as soap and towels. There should be a good barber shop in connection with this bath, where men should not be required to pay for the cutting of their hair, although a small charge could be made for shaving and shampooing. A good chiropodist should also be on duty at the baths.

Above all, these baths should be scrupulously clean and the men should be shown that the Army can and will provide better bathing establishments than those for which high prices are paid in cities under conditions of peace. In this connection it is believed that the Section d'Hygiene Corporelle of the French could be used with advantage as the basis for an American bathing establishment.

Some provision should be made for a good laundry, and this should be in charge of an experienced laundryman. No women should be employed at this place. It is believed that the sterilizing of clothing could best be accomplished either by the Herseher apparatus of the French or the Foden Thresh of the English. By this time there may be some steam sterilizing apparatus on the plan of the Kny-Scheerer made in our own country.

FEEDING THE MEN

The feeding of the men requires a very highly specialized department. The kitchen should be a large one, well ventilated, attractive, and furnished with a sufficient number of stoves to permit the cooks to devote themselves to specialties. There should be stoves for stews, stoves for baking, stoves for pastry, pies, cakes, etc., each being separate and each having its own cook. In this way there is great improvement in the quality of the food.

It was brought very forcibly to my attention that the method of the British at Boulogne in feeding the men should be copied, in the interest of economy in our own service. All men should be given to understand at the outset that they can have all that they want to eat and just as many helpings as they want, but that it is their duty never to take more on their plate than they think will satisfy their appetite—that they are sure they are going to eat. The kitchens adjoin the dining hall, a long counter for serving the men with food being interposed.

The men are introduced into the dining hall by companies, five minutes apart, instead of sitting them all at once. On entering the hall each man is given eating utensils, cups, plates, and paper napkins from the store of the mess hall. Armed with these, he proceeds, after the manner of a Childs restaurant, to the counter mentioned. By enlisting the cooperation of the men to the end that no more food will be taken on the plate than is needed, I was told by the commanding officer of one of the camps that in this way 10,000 pounds a year was saved in food which had previously been wasted by the portioning out of fixed amounts to each man.

In connection with this kitchen there are two important side issues. One is the convalescent-camp garden. In general terms a convalescent camp should produce all the vegetables it needs for its own support, but this garden should be utilized for the employment of men who will not go back to the firing line, rather than for the men who simply need to be rapidly built up for duty at the front. The distinction is thus made for the reason following.

Men who are to go back in a short time to the conditions of trench warfare should not be allowed to browse about too long in agricultural pursuits; their military life should be kept before them at all times. As one commanding officer of these camps states, "It seems like when they get into a garden they get to thinking what a terrible thing war is." Now, this we don't mind in the case of permanent base men, but we don't want to make our men who have to go back to the front feel bad unnecessarily.

The other adjunct is the conservation of food.

1. *Fat conservation.*—This is important for two reasons: (1) It provides suet for cooking and (2) it serves as a source of much material for certain munitions of war. The first necessity is subserved by the saving and rendering of fat trimmed from meat and taken from plates of men who have not consumed all that has been served them. The second is obtained from the fats of the kitchen waste, the garbage, and the scouring from kitchen sinks. This non-edible fat is rendered and is shipped in 300-pound casks to a salvage depot. The English render these fats on Soyer stoves, which are excellent for the purpose. The important part of this conservation is that the organization is paid a few cents a pound by the Ordnance Department for all fat thus saved for munitions.

2. *Conservation of food scraps.*—An enormous amount of meat and bread can be conserved for the making of hash, rissoles, and other dishes. It is noteworthy that these big kitchens have very few garbage cans—only one or two for a kitchen serving two to three thousand men.

3. *Conservation of solder from tins.*—At several convalescent depots we saw a large melting pot into which were thrown all tin cans. A hot fire was lighted two or three times a day and the solder allowed to run out through a funnel in the bottom. This was an important source of revenue for the camp, as the lead was sold in sticks of solder to the Government.

These camps require the most exacting sort of a sanitary officer. They should be models of sanitation. There should be night urinals placed between all barracks and, as before referred to, the latrines should be as perfect as it is possible to make them. Personally, I believe that the best possible disposition of feces at these camps is by incineration, and there is no objection at all to having these incinerators used for kitchen waste as well as feces; it will depend entirely upon the cleanliness of the latrine as to how near it can be placed to a kitchen. The pail system was so run in the British service that never in all of my many visits to their institutions have I smelt feces or seen filth in connection with such a system. Of course a good sewer system is best, but it will be rarely possible to attain. Fly-proof boxes for deep pits, after the American plan, is a possibility in certain terrain and is preferred by many British to their bucket latrine. The great point is that it is not only sanitation that we are after, but we are trying to preserve the sanitary conscience of our soldiers by appealing to their sense of decency. Therefore, these places should be always free from odor, always spotlessly clean, always provided with a comfortable seat and good paper with which the men may cleanse themselves. The urine should be allowed to flow away into a soakage pit, and an orderly should always be stationed on duty in charge of the latrine and the incinerator serving it.

As to the amount of fuel required for an incinerator, as will be seen from many papers issued by this school, that quantity is negligible. With a good camp refuse conservancy system 2 pounds of coke a day per incinerator for starting the fire is sufficient. But all camp refuse should be promptly dumped here daily.

The morning ablutions of the soldiers should be provided for by ablution benches, under cover, and with hot water for shaving. These can be near the latrine and the hot water obtained from pipes running through the fire box of the incinerator. In fact a washhouse for hands and face is best located in this vicinity.

It should be emphasized that there is no part of the upkeep and the daily service of a convalescent camp which should not be run by the convalescents themselves; gradually a permanent detail will be formed from P. B. men who can not go back to the front, men who have shown themselves to be particularly well prepared for identification with one or another of the services in the camp and who will always serve as nuclei around which men for these services will be grouped. The commanding officer will inculcate in these men, in addition to the strictest regard for military discipline, a decent regard for the ornate, and, as a result thereof, for the clean and neat. It should be deliberately taught men that it is not enough merely

to have the "rough stuff," the bare necessities; that men should improve their condition, that they should keep themselves and their surroundings clean if they expect to keep well; that they should keep their initiative, their ambition, their imagination active; that to make their barracks, their reading rooms, their camp attractive to the eye is to preserve those illusions of life which are necessary to make them contented and happy.

ENTERTAINMENTS

It should be noted that all too frequently the poorest form of entertainment for a soldier is the formula which somebody else has provided him to enjoy himself by. The most perfect entertainments that we have seen since we have been in France, generally vaudeville, it is true, but some serious concerts, have been provided by the soldiers.

The programs they have made up themselves from jokes which nobody ever wrote and from bits of waggy which you do not always find among professional comedians. The American people are especially gifted with a keen sense of humor, and we never see any humor keener than that displayed by our own healthy and care-free soldiers at the front. Civil societies who have taken unto themselves the diversion of the soldier can do their best work at these camps by providing the wherewithal for the soldier himself, and quite in his own way furnish his own amusement. Such entertainments, "hand made" by the soldier himself, plus the excellent ones provided so lavishly by our patriotic professional artists, musicians, and orators, work marvels in keeping a normal and healthful psychology among our men.

For a camp of 2,500 there should be at least one drum and fife corps, two brass bands, one orchestra, and one mandolin, guitar, and banjo club. By furnishing the instruments for these bands there never will be a dearth of musicians, and, as has been intimated previously, these camps can be a source of unborn bands for military services. The English made the great mistake of losing a great many of their bands, and in a general way it can be said that with music and healthful theatrical entertainment the spirits of the men never flag. Bands have an enormous influence in reviving the drooping spirits of men, and it is at these camps that such an influence is most needed. There should be some systematic effort, however, to train bands here, and just as there are trainers for physical exercises (to be spoken of later) there should be trainers in music and theatricals. There should be always plenty of music; the drills, games, etc., should be accompanied by music; there should be a drum and fife corps for parade, a band for retreat, and an orchestra for evening entertainments and dancing. There should be some music, good music, and not always merely a more or less agreeable noise. In addition to the amusement offered by bands, systematic effort should be made to draw out the men to take part in the theatrical entertainments above referred to. This requires a considerable amount of tact on the part of the commanding officer and really should receive the constant attention of some one person, because sometimes the most talented entertainers will go clear through a camp without displaying an iota of native ability which they have to a very high degree if properly brought out. Some of the best comedians we have seen have been quite accidentally discovered at these places. For these theatrical entertainments and minstrelsy, to which the American soldier takes very kindly, costumes should be freely supplied by the same patriotic civil societies who furnish the instruments for the bands.

Nor should these societies neglect to provide club rooms for noncommissioned officers and for men, reading rooms, writing rooms, libraries, a good gymnasium where many sports can be taught and practiced—boxing, wrestling, fencing, etc.

A sporting goods exchange should be provided where golf clubs can be obtained, tennis rackets, bats, balls, and all the paraphernalia that indoor and outdoor sports require. Some of the more expensive things should be rented. Some things, like tennis balls, baseballs, etc., sold.

This is an enormously important feature of these camps, and here it is that these civil societies can be seen at their best. For instance, it is believed that in the exercises and the games which they are taught, regular physical trainers should be employed rather than Army sergeants, for the simple reason that when men are being drilled by an Army sergeant or any one to whom they are in a military sense beholden, the tension of military discipline at these games, after the manner of a drill, places the muscles in abnormal positions and

under tension instead of relaxing them and freeing them from strain, which should be the object in exercising men for their physical good. These trainers should be good mixers and must learn how to tell when a man is bored or tired, and before the period of physical tire comes the mental tire should be recognized, and if it can not be gotten rid of by personal address the man should be switched rapidly to some other form of game or exercise. These games and exercises should be held at fixed hours, and medical officers on duty at the camps should always be on hand among the groups to see that everything goes well. Regarding this participation of civil societies, it is believed that it is the manifest destiny of the Red Cross to take hold of this matter inasmuch as this is a medical unit and is being used to return the soldier fit to the lines. In other words, this is a good opportunity for the Red Cross to cooperate actively with the Medical Corps, not merely to furnish candy and cigarettes. For this purpose not more than two experienced and matter of fact middle-aged women of the Red Cross Society could preside in a hut in which indoor games, checkers, whist, billiards, etc., should be conducted; little tables for writing provided, etc.

In other words, the whole spirit should be to make a man as comfortable as he can be and amuse him; at the same time he is being kept in a military atmosphere. There should not be too many orders, but general good discipline should be exacted, especially as regards cleanliness of person and surroundings, the rendering of proper salutes and the punctual attendance upon all formations. Loafers should always be kept busy at something.

THE PROFESSIONAL CARE OF MEN

Men should be given one general examination when they come in, but they should not be examined too often—every five or six days is enough. Men who have disordered action of the heart should be gone over carefully, and if the surgeon is satisfied that there is nothing the matter with their hearts of an organic nature he should not repeat the examination again unless absolutely obliged to do so from symptoms. In other words, it is not wise to have attention drawn to organic diseases at these centers. In fact the whole atmosphere of treatment—medicine, disease, etc.—should be avoided. The spirit of the place should be: "Here is the place for men to get fit in, and you need it. It depends on yourself how soon you fit yourself for the duties of a man." As a matter of fact in most of these convalescent camps there were very few actually in bed. In one (which cared for 3,000 men) there was only one hut which was known as a sick bay and that was empty but for one man. A powerful influence is the grading of men into the weaklings, those able to do something, and those who are getting husky and can do about everything. A spirit of self-betterment is thus fostered by appeal to the pride of the man.

As a matter of fact, these convalescent camps should be toward the zone of the army. I believe it would be inadvisable to have them way back in the rear, especially near large towns, although such centers will have to be placed near important bases for men who come to us sick from the States or who sicken after they get here. It seems that there are at least five kinds of institutions that could be grouped under this general heading "Convalescent camps" and that these institutions could all be administered along certain broad basic principles identical for all.

(1) A convalescent camp for the sick convalescents from disease, not venereal or neurological. All base hospitals should have or be near one of these.

(2) A convalescent camp to which men of (1) can be sent after a few weeks for hardening in order to enable them to return to the front. This camp could also receive men from the divisions direct who need a rest and change to prevent their breakdown.

(3) A camp for the correction of vicious postures and results of war wounds requiring reeducation and prescribed exercises.

(4) A camp for the handling of war neuroses.

(5) A venereal labor camp.

Army Sanitary School No. 124.

ICTERUS IN THE ARMY

Translation of summary of a lecture by M. le Medecin-Major Tanon

We will omit the study of icterus due to retention of the bile or obstruction of the bile passages. They are not of special importance and have been rarely observed. Angiocholitis perhaps may be noted as occurring in the course of an infection. Catarrhal icterus is rare. Some authors confuse it with ieteric spirocheetosis. It is necessary, however, to preserve it among the list of diseases to which soldiers are subject. The experience of war has shown that one finds most frequently two varieties of icterus among soldiers: First, picric acid-icterus, and, second, the hemorrhagic spirochetal icterus.

I. PICRIC ACID ICTERUS

This is an icterus due to simulation. It appears from two to four hours after the ingestion of 2 to 5 eg. of picric acid. It is a clear yellow, without constitutional symptoms, fever, or slowing of the pulse.

Diagnosis.—Chemical analysis of the urine can give us the diagnosis. The amount is diminished; it has a brownish yellow color and it has no biliary pigment. One finds picric acid when there has been a large dose ingested, or picric-pieramic acid—the chemical substance most frequently found, which gives with the hydrosulphide of ammonia a red color. But this examination is a delicate one. Numerous methods of technic have been proposed, none of which has an absolute value over others. Besides, men who have breathed gases liberated by the explosives whose base is a picric acid once have seemed to eliminate pieramic acid afterward. One finds it in the serum and in the secretions, which are yellow. In order to strengthen the diagnosis, it is necessary to question the patient closely and examine his haversack and his money pouch, where one may frequently find a little of the acid laid by.

Prognosis.—Benign. Intoxication even after a dose of from 5 to 20 gm. produces only vomiting and diarrhea and never death. Experimental (Roger) picric acid poisoning causes convulsions in a rabbit in a dose of 14 eg. and death after the administration of 19 eg. In man a fatal dose ought to be very high, because in a case of attempt at suicide with 25 gm. death was not produced.

B. ictero-hemorrhagiae spirochetosis, formerly known as relapsing infectious icterus, benign hepatic type, Mathieu (1889). Demonstrated to be due to a spirochete by Inada and Ido in 1916.

Spirillum.—*Spirochæta hemorrhagica* studied by the Japanese and afterward by the English and French. It is long; the spirals are few and broad, and easy to stain. It is found rarely in blood but always in urine after the tenth day. It causes icterus in 3 to 10 days, with hemorrhages in the guinea pig. At the autopsy we find a generalized icterus, muscular and subperitoneal hemorrhages, and the spirillum in the liver, kidney, and suprarenal capsules. It has not been cultivated, but the reaction of fixation by Martin and Petit is positive with the serum of those attacked by the disease.

Symptoms: Type, medium; infectious relapsing icterus.

(a) Preicteric period; weakness; digestive disturbances and temperature of $38\frac{1}{2}^{\circ}$ C.; rapid pulse, scanty urine, and muscular pains.

(b) Icteric period; begins on the fourth day; definite icterus of an ocher color. Constantly the symptoms improve and the temperature falls. Hemorrhage sometimes takes place (in half the cases); note the skin and mucous membranes; sometimes these may be serious. The urine increases in quantity and when this takes place the spirilla are abundant. There are biliary pigments and the normal color of feces disappears.

(c) The second febrile period; with temperature, rapid pulse, myalgia and frequently albuminuria. This period is more endurable to the patient.

(d) Convalescence is marked by a pronounced anemia, with albuminuria.

Throughout the attack the liver is a little enlarged and a little painful. The spleen is scarcely increased in size. The serum contains an excess of urea, which is of itself a factor of gravity.

Clinical forms: Type of "malignant icterus," with deep icterus, although never greenish; nervous phenomena, hemorrhages, symptoms of acute insufficiency of the liver, disassociation of pulse and temperature and retention of urea in the blood, from 0.50 to 2 gm.

The benign form and the catarrhal icteric type; examination of the urine and inoculation of guinea pigs fixes the diagnosis.

The aberrant forms: Myalgic or meningal, with stiffening of muscles of the neck.

There is a form without icterus, and the disease in such case is suspected in the presence of an epidemic. Examination of the spinal fluid would give us an opportunity to verify the presence of the spirochete.

Renal forms: Such forms may be the nephritis of the trenches.

Diagnosis.—Clinically, by the appearance and the icterus in four to eight days from the commencement of the disease, and by the recurrent type of the fever.

Bacteriologically, from an examination of the urine and inoculation of a guinea pig.

Prognosis.—Bad in the malignant forms of icterus; 40 to 80 per cent of deaths in Japan. Good in the medium form, which lasts from two to three weeks. It is necessary to watch the albuminuria and the anemia.

Pathological anatomy.—The lesions are superimposed upon those which one finds in the guinea pig. There is generalized icterus, spirilla in the liver, in the suprarenal capsules, and in the kidneys; there are hemorrhages under the skin, in the muscles, in the lungs, and upon the surface of organs.

Serotherapy of Martin and Petit.—The serum is prepared by injecting a horse 10 times with infected liver. Eighty cubic centimeters are injected subcutaneously in the patient, or 40 intravenously. It has been injected into the spinal canal with success in the meningal forms. Unfortunately, it does not take effect except at the early state of the disease.

Other drugs.—Arsenical preparations tried out by the Japanese have not been effective. It is necessary to support the heart and the fever diuresis in order to avoid the accumulation of unconsumed products of metabolism in the blood by cold baths. Salicylate of soda, 3 gm. a day, as an intestinal antiseptic and the chloride of calcium are useful.

Prophylaxis.—This is important and is based upon what is known of the etiology.

Etiology.—This is known, but incompletely. The rat seems to be always the reservoir of the virus (Inada and Ido). This is confirmed by English and French physicians in the trench rats. At Lyon even 5 per cent of sewer rats have been found to be infected. The flea may be the vector. The affection is always contagious, and it is necessary to disinfect the urine, the feces, and the sputum. The urine can still be found to contain the spirochete up to the sixth week. Wilmaers and Renaux have demonstrated it up to the thirteenth week. Before the tenth the spirillum is rare in the urine.

Conclusion.—Should all cases of icterus in which the pathogenesis is not clearly demonstrated clinically and from the history be considered as due to ictero-hemorrhagic spirochaetes? The answer is, No. One can suspect such cases, but the spirilla are not found in every case of icterus, and inoculations of guinea pigs are frequently negative (Fourth and Fifth Armies). It seems likely that there are some foci among our forces; for example, in the region of the Somme and in Argonne.

The etiology, the clinical picture, and the epidemiology are still the object of study.

An effort will be made to add only such notes as are not explained in the very full summary which accompanies the abstract of the lecture.

If a man takes more than from 2 to 5 cg. of picric acid, vomiting is produced. These cases of simulation come on just before an offensive or a raid, as a rule. There is no fever, no bradycardia, no bile in the urine, and no white stool. The symptoms appear from two to five hours after taking the drug. As picric acid is used in the manufacture of explosives, cases have been brought in after an attack by the enemy with jaundice and picric acid in their urine who had not taken the drug internally but had breathed in the gases and products liberated by the explosion of shells. Catarrhal jaundice is a rare disease at the front. The test for picramic acid in the urine is a very delicate one and one must be careful in reporting a positive finding. The general one employed is the hydrosulphide of ammonium which is added to urine containing picramic acid and which gives a red color. Picramic acid is said to be a derivative of picric acid, and the form in which it usually appears in the urine.

Another test is to add to the urine a solution of the hydrochlorate of cocaine. Pierie acid causes a dark yellow urine, insufficient in quantity. As the tests are fallacious at times, and as even in ease of a positive a man may aver to have inhaled pierie acid from the burst of shells, it is necessary to reinforce such evidence by a careful history taking, a sort of psychological research in the case and a prompt examination of the soldier's effects, particularly his pocketbook, in which one will often find some of the drug. This latter method can be used when the man will not acknowledge having taken the drug. In order to make him confess, it is perhaps better to present the matter to him in this way: "I personally know that you have taken pierie acid with the idea of avoiding your duty, and with that knowledge in my possession you are in a most dangerous position. Whatever legal evidence may be lacking will be insignificant in the face of the exposure of your case to your officers and your comrades, no matter whether we get you by trial or not. If you will tell me frankly how you came to take this drug and in what doses, you will be forgiven and nothing more will be said of it. Otherwise, you will be discovered sooner or later, for I am not going to drop the matter, as it is my business to follow these case to their termination, and then your sentence will be a heavy one—perhaps death."

A speech like this will generally produce the goods, and it saves a lot of trouble, for thus one is enabled to administer the only prophylaxis possible, a moral one by means of a good talking to; and the battalion will very soon find out that they won't be able to fool the doctor. One should always remember that these moral diseases are very contagious, and discovery and proper treatment in the first ones determine the size of the epidemic.

SPIROCHETAL JAUNDICE

Spirochetosis is a sporadic and not an epidemic disease. The urine must be sedimented by centrifuge and a smear of the sediment stained by Leishman or Levaditi. The spirillum has evenly pointed ends, but to make the diagnosis positive 5 c. c. of the suspected blood should be injected into animals and they will develop the disease in from three to five days. On autopsy you see a high degree of infiltration in the kidneys and hemorrhages in the pleura. The spirillum of hemorrhagic jaundice has a tendency to have buttonhook ends, and is found in the urine after the tenth day from the beginning of the disease. It is rare to find it in the blood, and it has not been successfully cultivated. Be exceedingly careful in reporting spirochetal hemorrhagic jaundice when you depend on the technic of staining by Chinese ink, as this ink contains very frequently a spirillum very similar in appearance which will confuse the diagnosis.

Spirochetal jaundice first appeared in the French Army in 1916 and there were 200 cases, but many of them had no jaundice.

Symptoms.—These are extremely variable.

The icteric period of the disease may come on the second or third day. The color of the patient is never greenish nor as deep as that of obstructive jaundice, and at the fall of the temperature when the icterus begins the patient feels well. Nor is the jaundice like that of yellow fever or malaria because the color is ochre. The convalescence is very long and marked by asthenia, anemia, and trace of albuminuria. The following temperature chart roughly gives the temperature by days:

The malignant form is very rare. It has not been seen in France. Benign forms are very common. Catarrhal forms are also uncommon. If you do not find the spirillum, do not call the disease spirochetal jaundice.

As in yellow fever, there is a second febrile stage with rapid pulse and albuminuria. The fever at the outset being about 39.2, gradually falls to a little subnormal the morning of the fifth day in a typical case, but in a few hours rises again to 39. In the recurrence of the fever the jaundice persists and purpura and albuminuria may occur, but generally the patient feels better and does not suffer much in this second attack. In the grave form the jaundice is deep; there are symptoms of acute degeneration of the liver; there is urea in the blood and the entire type is marked by severe nervous symptoms. The aberrant forms are very varied. Besides those mentioned in the summary, M. Tanon mentioned a grippal form. These forms are the ones which spread the disease because the diagnosis is arrived at too late. That is what happened in Champagne, in which epidemic foci did not exist. In the renal

form the icterus comes on from four to eight days after onset. There is an aberrant form which has been likened to dengue, and another to rheumatism or myalgia. The meningeal form resembles cerebrospinal meningitis. The form without icterus is doubted by M. Tanon in the majority of cases, and the renal form is similar to trench nephritis. There are two foci of infection: In the Argonne and the Somme. He is sure that whatever foci may to-day exist they are not in the Second and Fifth Armies, and if there are any cases they are only sporadic, which is usually the form which the epidemic takes. It should always be remembered that in spirochetosis there is bile pigment in the urine.

The pathological anatomy.—The organs especially affected are the liver, kidneys, suprarenal capsules, lungs, the surfaces of organs, and the skin (purpura).

The diagnosis.—This is made by examination of the urine, by the symptoms, and by inoculation of animals.

Prognosis.—In epidemics here the mortality has been 1 to 2 per cent, but the convalescences are slow, and it is a costly disease to troops from inaction of the sick over long periods. It is 80 per cent in the malignant forms.

Prophylaxis.—The rat is probably the carrier and food soiled by them will convey the disease, as also will the sputum of infected persons. It should be remembered in this connection that the spirochete may remain from five to six weeks in the urine. He mentions the fact that the rat flea may carry the disease, in addition to the urine and feces of rats.

From the beginning of the war there have been 500 cases in the French Army and 2 per cent of deaths.

The treatment.—First, serologic. This is not a prophylactic and does not go after the icterus.

Second, medicinal. All medicines are mere palliatives. Horse serum and calcium chloride can be used for hemorrhages, and the drug is salicylate of soda given in doses of 3 gm. per day.

Army Sanitary School No. 127.

ROUTING AND HOSPITALIZATION OF EAR, NOSE, AND THROAT CASES

By Lieut. Col. James F. McKernon, M. C., N. A., senior consultant, ear, nose, and throat surgery

1. Simple acute ear and throat conditions will be held wherever possible at camp and field hospitals until recovery.

2. *Evacuation hospitals.*—(a) Injuries confined to ear, nose, and throat will be evacuated directly to Base Hospital No. 115. Cases of multiple injuries requiring special treatment will be evacuated to Base Hospital No. 115 whenever general condition of patients warrants. (b) Shell-shock cases, either deaf-mute, totally deaf, or markedly hard of hearing, to be evacuated directly to Base Hospital No. 115.

3. *Base hospitals.*—Will transfer following to Base Hospital No. 115:

(a) Cases requiring reconstructive treatment.

(b) Cases of multiple injuries requiring special ear, nose, and throat treatment whenever general condition of patient warrants.

(c) Patients with prolonged ear suppuration and the condition of whose hearing would permit their continued service overseas.

(d) Patients showing disturbances of stasis labyrinth.

(e) All shell-shock cases, either deaf-mute, totally deaf, or markedly hard of hearing.

(f) Patients with chronic accessory sinus infections.

(g) Patients requiring laryngoscopy, bronchoscopy or oesophagoscopy.

CONDENSED SCHEDULE OF TREATMENT EAR, NOSE, AND THROAT CASES

Wounds of ear, nose, and throat to be treated according to the principles of general surgical procedure—removal of missiles and other foreign material, debridement with primary suture or drainage as indicated.

Tubal catarrh: Inflation and vaporization of tube and middle ear, local applications, 2 per cent silver nitrate to pharyngeal end of tube.

Acute otitis: Free incision of drum membrane in posterior, inferior quadrant, extending into Shrapnell's membrane. Follow by hot saline or boric acid irrigation, 2 quarts q. 2 h.

Furunculosis: Free incision followed by hot saline dressings. Recurring and multiple, vaccines, preferably autogenous. Stock vaccines—mixed staphylococcus for furunculosis to be obtained from central laboratory.

Mastoiditis: Nonoperative—treatment of acute otitis as above, observation, period limited to few days. Operative—removal of diseased bone, establish free drainage between mastoid cavity and middle ear, close superior angle of wound with sutures and treat as open wound by packing.

Brain abscess: Suspected cases to be reported immediately to senior consultant.

Sinus thrombosis: Substantiate by blood cultures where possible; uncover sinus from above knee well downward toward bulb. If parietal or organized clot, evacuate, pack and treat as open wound. If clot broken down and pus present, treat as above, and in addition ligate and resect internal jugular vein from clavicle to point above facial vein. Close neck wound and drain from lower angle.

Nose: In all mucous membrane irritations due to gas, local application of lime-water or bicarbonate of soda. In larynx and trachea, inhalations of camphor and menthol (aa Gr. xxx), oil of eucalyptus (5iv), compound tincture of benzoin, q. s. ad ounces ii. Intralaryngeal injections guaiacol, 2 per cent camphor and menthol 4 per cent in liquid albolene or boiled linseed oil. Where deviation of septum is sufficient to obstruct respiration, a submucous resection should be done. Otherwise let alone. Accessory sinuses, acute involvement, shrinking tissue, inhalations and warm saline irrigations, suction followed by sprays. Remove middle turbinate if necessary to establish drainage. With pus discharging, open and drain.

Pharynx: Acute follicular tonsillitis—frequent hot saline gargles, medication, sodium salicylate, etc. Tonsils to be removed only when markedly hypertrophic or diseased, and then by method producing a minimum of trauma. No tonsils to be removed during acute inflammatory process.

Adenoids: When present and causing obstruction to be removed.

Abscess: Peri-tonsillar and retro-pharyngeal—free incision and drainage.

Larynx: In acute conditions, warm inhalations, sprays, cold compresses, external. In gas cases, as noted under "Nose."

Laryngeal edema: External applications of ice when obtainable. Spray of adrenalin, or lemon juice, following in half an hour by deep pharyngeal irrigations of hot saline solution, 2 or 3 quarts at each sitting.

Trachea; pharynx: Foreign bodies, laryngoscopy, bronchoscopy, tracheotomy, when indicated.

Army Sanitary School No. 128.

VISIT TO BRITISH CONVALESCENT CAMPS IN THE VICINITY OF X——, BY GROUP
UNDER COL. BAILEY K. ASHFORD, THIRD SESSION, FIELD SERVICE SCHOOL FOR
MEDICAL OFFICERS.

CONVALESCENT CAMP NO. 10

Under the command of Lieut. Col. C. D. Myles, R. A. M. C.

This camp is one of the best in the British Army. It has accommodations for from 3,000 to 5,000 patients. It is out in the open country on a high plateau, surrounded on three sides by a deep ravine, well wooded, through which runs a pleasant stream of water. It is exposed to wind, but is well furnished with hard roads and adorned with pretty gardens. There was no shade, however, in the camp itself. Every bit of it had been built by the convalescents themselves.

It is under the command of Lieut. Col. C. D. Myles, R. A. M. C., and is about 5 miles south of a city. Colonel Myles says that he tries to make requisition for as little as possible, and every particle of work, construction as well as upkeep, is done by means of convalescents, with the exception of a little assistance now and then from skilled tradesmen sent out for the purpose; the ablution benches, cookhouses, and latrines, however, were built

by contract. He made the remark that the cookhouse is in the wrong place, because they had put it on level ground. He states that it should be an axiom in a convalescent camp to use the level ground for recreation; everything in the shape of a house should go on rough ground. The cookhouse is the only house that was built by tradesmen. He started with 70 patients and they put up 67 huts in 7 weeks, each hut being 20 by 60 feet. In one instance, 3 huts were put up in 12 hours. At present there are 2,500 men, divided into 2 divisions of 1,250 men each. The present staff consists of one first-class officer and four second-class officers. He states that you need a tremendous amount of space in a convalescent camp. As he expressed it: "You have 2,000 men to keep moving, and they need room to move in. Otherwise you have to send them out on route marches, and a little of that sort of thing is all right, but too much is not only no good but a positive detriment, as there are not enough noncommissioned officers to enforce the discipline on long marches. When you get two or three thousand men on a hike it is a pretty big affair. They all go out for about an hour and a half every day, and every Sunday we turn them all out." This camp was begun on the 8th of April, 1917.

Amusements.—When we reached this place two of their bands were playing during exercises which were going on. There were four bands and an orchestra—in all 130 instruments. We went into the theater, which was well painted and decorated. The curtain was especially lively, inasmuch as it was decorated with a choice variety of witty advertisements. The Red Cross hut had a good billiard table, separate small tables for writing letters, library, music by an orchestra, and the lady in charge stated that they have a fancy dress ball on Tuesday nights and that they had two dances a week. I asked Colonel Myles whom they danced with, and he said they danced with each other.

Games.—Tennis, cricket, football, baseball, and golf were favorites, and also boxing. Every kind of athletic apparatus was furnished. Most of these goods could be drawn on memorandum receipt. Some of the things could be bought—baseballs, tennis balls, golf balls, etc. The Canadians are fond of baseball; the Scotchmen like golf and cricket. One hut is used for a post office. They have a very good canteen, which was well furnished, and there were all kinds of pleasing lithographs on the wall.

The latrines were of the usual bucket type, with incinerators. These incinerators were kept up by camp refuse, and altogether provided 120 gallons of hot water a day, which is given the men for washing up in the morning at the ablution benches.

The gardens were run by P. B. men as a rule, and effort is made to make the place as ornate and neat and attractive as possible.

As a sidelight on the manner in which the camp was embellished, he showed us a Japanese garden of some oriental queen, with a fanciful name given it by the soldiers. It seems that an English officer had a faithful Japanese body servant, over 65 years of age, who broke down from arduous service at the front and was sent here with the remark that he had to be kept and provided for as long as there was an English Army. Colonel Myles stated that he was a "Canadian Jap" who had been 10 years in America and couldn't speak a word of English, and that at first he only moped around. He used to go off by himself and be gone all the afternoon. "The first thing I knew I was always running across some of his whirligigs like those things over here"—we were at that time inspecting the garden—"He said he wanted to work out a Japanese garden, and this is the result. Everything is his own idea and has been done by himself. That is his idea of a lighthouse on the top of a mountain. He never saw a lighthouse, but that's where he thinks it belongs, and he has made a prayer tower of it. He is a quiet and peaceable man and but for an incident with the carpenter, after which he spent some days in hospital, his record is good, and you see he has certainly beautified the place. The only thing is we can't let him near the carpenter shop. It cost him an argument the first time he went. He don't know a chisel from a saw and uses both for the same purpose." What we had seen was simply a little Japanese garden into which on uneven ground this Japanese had all by himself led water from a stream which he had dammed up, and utilized the power thus obtained to turn windmills and manikins which he had fashioned himself out of wood.

We were interested to find out that the only game at the place for which a charge is made is golf, and that was 2 pence an afternoon.

It was interesting to watch the games. A circle was formed consisting of some 50 men, and some pretty lively games were started. One of the favorite amusements was to imitate the trainer in certain exercises in which he gave the command "Do this" or "Do that." All orders worded "Do this" were to be obeyed and all those worded "Do that" were not to be obeyed. The result was that the men were kept not only thoroughly alive physically but mentally as to what was going on and their alertness was thus brought back, inasmuch as there is a punishment for doing something from a false command, a run of 100 or 200 yards or something equivalent thereto. These games take place in the morning and the hikes in the afternoon.

We heard some excellent music by a Scottish bagpipe band, and these bands all had very elegant uniforms.

One of the most interesting little details in neatness and ornateness of an attractive sort was noted at the entrances to the barracks of the men. There were usually two steps leading to the door, and at the base was a neat little space inlaid with baking-powder cans turned upside down, giving a model doormat, as it were, for getting rid of mud before entering the house.

The sergeants were messes separately from the men. The kitchens and dining rooms were models, both for men and noncommissioned officers. It was here that we saw a particularly good plan for salvaging solder and fat. The men sleep on a bed of straw and are furnished three blankets. As we walked through, all these beds were neatly rolled up and not a wisp of straw was visible. The floors were polished and the place was immaculate. There was only 1 hut out of 67 given over to hospital and there were only 2 or 3 patients in it. There is a dental surgeon on duty here who is said to be kept pretty busy. Carpenter shops, tailor shops, ironworking shops, etc., were noted for industrial education.

Colonel Myles said the men spent an average of three weeks at this camp and are not allowed to stay over six. This entire depot was a model of excellence in every particular. Everything was in its proper place and everything was clean and orderly. There was no waste of any kind of water, food, or material.

On leaving I asked the commanding officer if he didn't have a hard time getting all the buildings and stuff together to make this village of 3,000 men. He looked at me very expressively and said: "I have lost all of my friends I think that I ever had in the Army; I am afraid to go out because every stick on the place represents an argument."

CONVALESCENT DEPOT NO. 6, AT ETAPLES

This officer describes D. A. H. as treated at Etaples. The diagnosis of D. A. H. is recognized by the regimental medical officer, generally on the following symptoms: Dyspnea, pain over the heart, rapidity of pulse, etc. On these symptoms, generally, without any particular analysis of signs for lack of time in which to make a fine diagnosis, he is sent to the C. C. S., where his diagnosis may change to V. D. H. which causes him to be conveyed to the base. Here the correct diagnosis is arrived at by methods familiar to scientific medicine. It is not necessary to take cardiographs in every case because (1) in simple irregularity of the heart nothing shows and (2) it is a costly thing to always take a cardiogram. It should be made, however, if the patient's age is over 40; also if there is any serious irregularity or any organic signs.

The disposal of heart cases.—(1) Those in which there is really no disease—nothing radically wrong with them. Such are sent back to the line.

(2) The rest, divided into: (a) Those fit for garrison duty; (b) those fit for labor duties in the lines of communication or at the base; (c) those fit for clerical duties or as cooks.

(3) Cases which have to be sent home.

If now, at the general hospital, we clear up a focus of infection and, after treating everything that we can treat, we still find that the man is not even fit for garrison duty on account of D. A. H., that man should go to the convalescent camp. It is necessary that a man should go through a convalescent camp before going to a training camp; there is too wide a difference, too big a gap, between the sick bed and the training camp to be bridged in any other way. The D. A. H. cases should spend six weeks at a convalescent camp; two weeks on the first exercises; two weeks on the first and second exercises; and two weeks on the first, second, and third exercises.

The following classification, G. R. O. 2959 of the British Army, is rehearsed as follows:
Classification of personnel by categories:

A. Fit for general service.

B. Not fit for general service, but liable to reclassification as A.

B (1). Fit for garrison units, division employment companies. Area employment (G. Gd) companies, labor companies, employed at the front; N. C. O.'s as permanent staff for reinforcement camps and convalescent depots; men for employment in lieu of R. A. M. C.; nursing or general duty orderlies and stretcher bearers in the lines of communication.

B (2). Fit for labor corps units employed on L. of C. or other duties of an analogous nature.

B (3). Fit for sedentary work as clerks, storemen, batmen, cooks, orderlies, other than R. A. M. C., sanitary duties, or, if skilled tradesmen, at their trades.

MB. Officers and other ranks sent from hospitals and convalescent depots to medical board base ports for classification in A, B, or E.

E. Unfit for service in France or at home. To be sent home, discharged as unfit for further service.

I visited the gymnasium and watched the sergeant-major directing the games, etc. The men taking exercises were all smiling, enjoying the work, and had plenty of music. They have old country-style dances under the direction of a woman and two assistants for 30 minutes. All the class did it and thoroughly enjoyed it. From what I saw, no true cardiac could have stood it. One hour in the afternoon is devoted to hikes with music if possible.

They have five classes:

A, the first week—for light exercises;

B, the second week—heavier exercises;

C, the third week—heavier still;

D, the fourth week—heavier still;

E, the fifth week—very heavy exercises. Course for trained men.

At the end of each course the medical officer inspects the cases.

Disposal of D. A. H.

First 900 cases:	Percentage
Total placed on courses.....	52.3
Not considered suitable for courses.....	47.7
Disposal of those not considered suitable:	
1. To their unit.....	1.1
2. Ordinary prolonged convalescence.....	10.9
3. To hospital.....	5.0
4. Recommended base work.....	29.5
5. Recommended dental treatment.....	1.2
	47.7
Disposal of those placed on course:	
1. To their unit.....	15.0
2. Recommended T. B. T.....	18.5
3. Hospital.....	5.5
4. Recommended base work.....	13.3
	52.3

CONVALESCENT DEPOT NO. 1

Convalescent Depot No. 1 is under the command of Lieut. Col. J. E. Campbell, by whom we were taken through on the 18th of March, and afterwards entertained by Lieut. Col. W. E. Hume in a lecture on disordered action of the heart (D. A. H.).

This camp was beautifully situated on the top of a hill near a statue of Napoleon. This particular hospital receives heart cases. The average stay here is 29 days. In the last six months 5,100 cases have passed through and been returned to the front. In the old days

these men used to hang around base hospitals from eight to nine months. This depot is a most comfortable barrack camp of 54 Nissen huts, with two large courts, leveled off and hard bedded with broken stone, in which many groups of men are seen doing exercises or playing games to the music of bands. The men all looked happy and interested and there were no slackers. All bands are composed of convalescents or P. B. men. It was explained to us that the men were divided into three classes for exercises; the third class, in which the games are light, sometimes little more than looking on while the instructor goes through the movements. These instructors are civilians and are regular trainers in physical exercises. If the men are observed to be bored during the course of these exercises, they are rapidly changed to games. In this class exercises are prescribed from 9 to 9.20 and from 11 to 11.20 a. m. When they get stronger they are taken for a light route march of an hour or an hour and a half in the afternoon.

In the second class the games are more energetic and the marches longer.

In the first class the games are strenuous—football, baseball, etc., and the marches approximate military conditions.

In commenting on the class of cases admitted to the hospital, the commanding officer states that there all men are examined on admission and graded into one of three classes without regard to their ability to do exercises. First, the nervous cases; second, the cases of general debility; and third, those heart cases of which we have spoken. There are 10 companies of 250 men each when the hospital is full, and each company has a sergeant major in command of it. It is organized on regimental lines. The commanding officer states that tobacco is not so bad in upsetting men, but that alcoholics are a pretty difficult lot to get fit. He also states that the dentist is kept busy pretty much of the time. It is recognized among the English that much chronic ill health is due to dental disease.

We were told that there are two types of convalescent depots in the British Army. One that receives hospital cases direct, of which this is a type, and another, which this one feeds, for country and rough work, and has about 5,000 men. Exercises here are more lively. In his hospital the men rise at 6 a. m. He states that although there is a garden he doesn't believe very much in putting men there if they are going back to the front because "they are liable to get to thinking how terrible a thing war is." On the other hand, the work on roads and walks and flower gardens, the landscape gardening, as well as the regular upkeep of the hospital falls on the convalescent patients.

We saw a fife and drum corps, band, and orchestra. The band was playing in a Red Cross recreation room, where there was a "sister" in charge, some 45 years of age, a very bright, sensible woman. She organized games and concerts and had a fine, well-furnished hut, with stained paneling and rafters, billiard table, reading room, with small tables and individual lights for writing letters, library, etc. She said that they have concerts on Thursday nights at which the program is furnished by the men, by whom, indeed, practically all their amusements are.

The hospital has beds for 2,600 patients and is 10 miles in the country, on the top of a sandy hill overlooking the channel. There are 120 acres for all kinds of games, golf, tennis, cricket, etc. All men entering the camp are questioned as to their particular fitness for work as artisans, and as a matter of fact there are carpenter shops, tin shops, barber shops, cobbler shops, leather shops, electrical shops, paint shops, etc., to accommodate all workers at the common trades. The Horsfall incinerators were used at this camp. They were allowed one bag of coal a day, but as a matter of fact they saved all their fuel allowance after starting the fire with coke, as camp refuse is used to keep them going. Coke cinders and used tea leaves are considered splendid fuel as they give a hot fire. In this camp the urine from the buckets in the latrines is drained off into a septic tank. Near the latrine is an ablution room with hot water for shaving which comes from the pipes which surround the fire box of the incinerator. This camp has been bombed, and they are engaged in making a dugout for patients with a system of trenches.

The disinfectant used here was the Foden-Thresh.

The bathhouse had individual showers and 12-inch cement basins used as tubs under same for reclining baths; steam rooms for Turkish baths, etc. Some of these bathrooms were separated by curtains and everything was neat and clean. The material of which the

buildings were constructed was a composite in which asbestos and cement took prominent parts. The men are bathed three times a week in a body; that is, they make a parade of it. Both hot and cold water is furnished at all times and many comforts are provided, such as duck-board seats for dressing, bathing, and foot rests, etc. Twenty men can bathe in this wooden hut at once. The pipes are all wrapped to prevent freezing and the water is heated by the Charles Blanc heater, familiar to us all. All men who get a steam bath get a temperate douche afterwards, and there is an alarm bell inside for men who might be overcome from the heat, which rarely happens. In spite of the fact that this hospital is filled with heart cases, it is not considered dangerous to send them in there to bathe. In connection with all this, there is a good barber shop where the hair is cut free, but two pence are charged for a shampoo and 1 penny for a shave.

They have a laundry in connection with this bath, but they washed only towels, shirts, and underclothing there. The men have no sheets or pillowcases, but sleep between blankets. This laundry handles 1,200 articles a day and the personnel are convalescents. There is a hand-mangle laundry and a drying room heated by a stove; this drying room is ventilated by a removable intake of air through a flue in which the outside air is passed through the fire grate before diffusing into the room. Next to this was a place for examining the clothing for nits of lice. If any are found the seams are ironed. The anterooms for dressing and undressing in this bath were very commodious, and near by was a gymnasium where, among other things, boxing was evidently well thought of. In fact they were teaching some Portuguese soldiers to box when we reached there, and they put up a very nice little contest. They had some pretty lively intercompany boxing.

The kitchen.—The kitchen was attractively arranged and had many simple, neat devices. Very little food is thrown away; there are only two refuse cans for the entire day's waste for 3,000 men, and 10,000 pounds were saved on food last year from ration allowance. Besides this, 1 ton of fat a month is saved for munitions. The kitchen is run by B class men, and they have 13 cooks in this hospital. They say they never turn out of the Army any man who is able to do light work, and many are kept here, either in the shops or kitchens or band. A great specialty is made of the conservancy of fats, the first grade being used as drippings for cooking and the second class recovered from slops and garbage for munitions. It is sent back in 300-pound casks to be utilized for the latter purpose, after being previously rendered in Soyer stoves. The stoves were labeled "Roast," "Stews," "Fries," "Pastry," etc. There was one for rissoles, puddings, and porridge, and another for tea. Each stove was presided over by its own cook and was neat and clean. The stoves were English. The cooks are B men and the assistants are B (1) and B (2). At the time we were there there were 7 companies of 250 men each. Each company entered the dining hall five minutes after the other to facilitate serving and the nearest table is filled first, so that those coming in last are near the door. No smoking is allowed during meals. They are served from a counter and eating utensils are furnished at entrance. Any man can have as many helpings as he pleases. As a result there was a saving of 10,000 pounds a year at this hospital on food alone.

In connection with this kitchen there was also a melting pot for rendering solder from tin cans, which made a handsome saving on lead, amounting to a hundred pounds a week. The tins are rolled out and at the tin shop many useful articles are made from them.

There was a fine clubroom for noncommissioned officers, with its own private bar, billiard room, writing rooms, etc. A feature of this hospital also was the clothing and equipment department. When a man arrives from the hospital he comes with a statement as to his equipment and this shows what he needs, which is furnished from the pack store. The sergeants have a separate mess, in addition to a separate canteen.

There was only one hut for medicine and surgery together, and that had only one patient in it. We saw a cobbler shop, carpenter shop, and electrical shop, in addition to those mentioned heretofore.

NOTES ON COLONEL HUME'S LECTURE

At this hospital, to which an endeavor is made to send all the D. A. H. cases, there is a medical board base department (M. B. B. D.). This is in addition to the hospital and the distributing center (D. C.).

Men who come recently from civil practice are apt to put too many cases down as vascular disease of the heart (V. D. H.), where, as a matter of fact, such cases are apt to be doubtful. As an illustration of the mistakes in diagnosis which are made in regard to heart conditions, of 55 cases sent in as V. D. H. 22 were really D. A. H. and 1 N. Y. D. H. (not yet diagnosed, nervous). A man with V. D. H. ought not to be kept in the Army at all but sent to England. Such cases are often a sequela of rheumatism, but D. A. H. comes from all kinds of disease and is only a symptom; even any fever can cause it. The rate of the heart is increased always in D. A. H. at least 50 per cent. Generally it is between 90 and 100, but while the patient is sleeping it is apt to be very slow. For instance, a man may have a pulse of 140 while he is awake which may drop to 70 while he is sleeping, and this in itself is a distinctive point between it and Graves's disease in which you never see the pulse drop in this dramatic way. If you find a murmur and you can not prove that the heart is enlarged and there is no accentuation of the second sound, and no history of rheumatic fever, and no deviation of the apex of the heart to the left, you can throw out that murmur as functional. But remember that the outline of the heart by percussion is fallacious and not to be depended upon; radiologic evidence is much better. It is very easy to get a functional murmur in exhausted states. The systolic blood pressure in D. A. H. is apt to run high—130 to 135; the diastolic pressure from 100 to 110, but the peripheral pulses are apt to be poor. When there is pyrexia due to trench fever there is apt to be a leucocytosis.

About half of these cases had no symptoms before they came into the Army and they are often people who worked at light jobs and had led sedentary lives before they came into active service. These two classes of cases, V. D. H. and D. A. H., used to be distributed throughout the general and base hospitals with their diagnosis stuck persistently to them. They were known as heart cases, and it was no secret to the patients themselves. Some of these cases of D. A. H. thought to be organic diseases were partly, if not entirely, neuroses, and in this manner they became fixed ideas.* As before stated, their average stay in the hospital was eight to nine months. The difficulty was that no one had the courage to say that the man had no disease of the heart at all. What ought to have been done was that when the man came in from the C. C. S. with diagnosis of D. A. H. or V. D. H. he should have been sent direct to this sort of a convalescent camp. The custom here is to have a careful history taken and the previous health and habits looked into, and after the history is taken a physical examination is made. That is to say, an attempt is made to definitely fix at this examination whether the man is or is not D. A. H. or V. D. H., and according to this examination men are either put to bed or sent to light duty or exercise. The men with pyrexia of unknown origin (P. U. O.) are put to bed, and when they are convalescent you can get them up and give them exercise, beginning in the morning with 20 minutes at 9 o'clock and 20 minutes at 11, and a light march of an hour or an hour and a half in the afternoon. Every fifth or sixth day there is a reexamination, but a man's heart is never examined more than once when you are satisfied there is nothing the matter with him. There is really no such clinical entity as D. A. H., and all cases of V. D. H. are discharged. The following shows the number and percentage of the diseases entering the hospital under the name of V. D. H. and D. A. H. after proper diagnosis.

Diseases	Number	Percentage
Other diseases.....	83	8.3
V. D. H.....	55	5.5
D. A. H.....	562	56.2

Distribution of a thousand cases definitely known as heart cases after examination

D. A. H.....	770
V. D. H.....	169
Cardiovascular.....	61

* D. A. H. is known in the American Army as effort syndrome.

Main symptoms and signs in a thousand cases of D. A. H.

Symptoms	Per cent	Signs
Pain.....	76.8	Heart tenderness.
Breathlessness.....	67.5	Rhythm.
Giddiness.....	40.3	Size.
Palpitation.....	35.4	Sounds.
Fits, fainting:		
(a) Unconsciousness.....	9.8	Blood pressure, peripheral.
(b) With consciousness.....	2.5	Blood pressure, skin.
Exhaustion.....		Nervous system.
Headache.....		
Nervous irritability.....		Blood.
Sleeplessness.....		Urine.

Relation between V. D. H. and rheumatic fever (R. F.)

Lesion	Number	Rheumatic fever	No rheumatic fever
Aortic regurgitation.....	11	6	5
Mitral stenosis.....	17	10	7
Mitral insufficiency.....	19	11	8
Mitral stenosis and aortic regurgitation.....	5	4	1
Paroxysmal tachycardia.....	3	0	3
Totals.....	55	31	24

Percentage: Rheumatic fever, 56.3; no rheumatic fever, 47.7.

A thousand cases of D. A. H. arranged according to age

Age	Percentage	Percentage of 2,000 other cases not in this series	Age	Percentage	Percentage of 2,000 other cases not in this series
15 to 20 years.....	7.9	11.15	35 to 40 years.....	10.9	11.56
20 to 25 years.....	33.3	32.95	40 to 45 years.....	8.4	7.5
25 to 30 years.....	23.1	22.05	Over 45 years.....	2.6	1.75
30 to 35 years.....	13.8	13.05			

In a thousand cases of D. A. H., 108 had suffered from rheumatic fever, or 10.8 per cent. Shortness of breath sometimes becomes hyperpnea and you may notice as many as 60 to 80 respirations, but this is a hysterical trick and not real breathlessness. Giddiness is common; so is palpitation. The fits and faintings are not hysterical and should be separated out from petit mal. Hyperesthesia is precordial.

In general 50 per cent of the cases complain of "heart trouble" before enlistment.

There are three great types of individuals who furnish the heart cases: (1) Young men who never played games or took exercises; (2) the trench fever cases; (3) the functional (hysterics and malingerers) which form part and parcel of shell shock. In this shell-shock group the bad nervous symptoms are apt to disappear in a whirl of tachycardia. True malingering is extremely rare.

A thousand cases of D. A. H. in relation to the pulse rate

Rate	Per cent	Rate	Per cent
40 to 50.....	0.1	100 to 110.....	23.08
50 to 60.....	.4	110 to 120.....	15.7
60 to 70.....	1.8	120 to 130.....	11.3
70 to 80.....	8.5	130 to 140.....	1.4
80 to 90.....	13.5	140 to 150.....	.9
90 to 100.....	22.4	150 to 160.....	.1

A thousand cases of D. A. H. with onset before enlistment

Attributed to—	Number	Number discharged fit	Attributed to—	Number	Number discharged fit
Indefinite.....	307	191	Rheumatism.....	4	1
Rheumatic fever.....	82	40	Diphtheria.....	3	1
Definite effort or trauma.....	56	30	Malaria.....	3	2
Faints, fits.....	21	12	Tonsillitis.....	2	1
Pneumonia.....	18	9	Asthemia.....	2	1
Typhoid.....	14	7	Jaundice.....	1	0
Scarlet fever.....	9	2	Rareities.....	2	2
Influenza.....	9	1			
Pleurisy.....	6	6	Total.....	542	308

A thousand cases of D. A. H. with onset after enlistment

Attributed to—	Number	Number discharged fit	Attributed to—	Number	Number discharged fit
Indefinite gravity.....	236	148	Fits and faints.....	5	1
Definite effort.....	57	26	Bronchitis.....	4	2
Shell shock.....	36	20	Rheumatic fever.....	3	0
P. U. O.....	31	26	Scarlet fever.....	2	0
Buried.....	21	13	Typhoid fever.....	2	0
Gassing.....	18	8	Tonsillitis.....	2	0
Wounds.....	11	6	Jaundice.....	2	2
Trench fever.....	8	6	Rheumatism.....	2	1
Dysentery.....	8	3	Measles, pneumonia.....	2	2
Influenza.....	6	6	Pleurisy, anemia.....	2	2

A thousand cases of D. A. H. in relation to discharges

Discharged	Total	Percentage	Percentage in 500 cases	Discharged	Total	Percentage	Percentage in 500 cases
Fit, "A" class.....	570	57.0	59	Hospital.....	50	5.0	4.0
P. B. ordinary.....	172	17.2	19	England, unfit.....	6	.6	.2
P. B. light.....	44	4.4		Unknown.....	17	1.7	
T. B.....	86	8.6	16	In camp.....	45	4.5	

Industrial condition of 1,000 cases of D. A. H.

Light work, general labor—servants, painters, butchers, etc.....	256
Open air laborers.....	206
Sedentary workers.....	178
Heavy industrial labor.....	152
Light industrial labor.....	125
Army, Navy, and merchant marine.....	54
Indolent, easy going, and of uncertain occupation.....	29

Personnel convalescent depot (2,000 to 5,000 beds), war establishment

Detail	Officers	Warrant officers	Staff sergeants and sergeants	Rank and file	Total	Remarks
Lieutenant colonel, R. A. M. C.....	1				1	*May be drawn from any Army of the service.
Captains or lieutenants, R. A. M. C.....	6				6	*Included 1 corporal and 2 dental mechanics.
Adjutant and quartermaster.....	1				1	
Assistant adjutant and quartermaster.....	1				1	
Sergeant major (W. O., class 1)*.....		1			1	
Quartermaster sergeant (W. O., class 2)*.....		1			1	
Sergeant cooks.....			2		2	
Dispenser, R. A. M. C.....			1		1	
R. A. M. C. rank and file (for detention hospital).....				10	10	
Attached: Dental surgeon.....	1				1	
Total.....	10	2	3	10	25	

No. 1 convalescent depot, Boulogne—P. B. personnel for 2,500 beds

Detail	Officers	War- rant officers	Staff ser- geants and ser- geants	Rank and File	Total	Remarks
Censors (P. B. officers).....	3				3	*1 typist.
Acting sergeant majors.....		3			3	
Acting quartermaster sergeants.....		3			3	
Acting Co. sergeant majors 1 per 250 men.....		10			10	
Clerks.....			1	* 5	6	
Pay sergeant.....			1		1	
Carpenter.....			1	1	2	
Tailors.....			1	1	2	
Barber.....				1	1	
Police.....			1	3	4	
Shoemakers.....			1	1	2	
Sanitary duties.....			1	6	7	
Batmen.....				8	8	
Total.....	3	16	7	26	52	

Army Sanitary School No. 131.

INDICATIONS AND GENERAL TECHNIQUE OF AMPUTATIONS IN FRESH WAR WOUNDS

By Medecin-Major Mocquot

(Translation of summary)

WHEN, WHERE, AND HOW MUST ONE AMPUTATE?

1. *When must one amputate?*—Amputation may be indicated, primarily, before the appearance of the clinical signs of infection; secondarily, after their appearance.

a. In what cases is primary amputation indicated?

(1) When amputation is quite or almost accomplished by the trauma.

(2) In complete crushing where mortification of the distal part is unavoidable.

(3) In certain cases of grave injuries of bone and soft parts not necessarily productive of gangrene. In such cases the decision is based on—

(a) General factors: Shock. Certain patients in shock, especially after bleeding, must suffer amputation; perhaps some other forms of shock also. On the other hand, operation is fatal in other cases.

General condition of the wounded, their age, etc.

(b) Local conditions: Distinction between the upper and lower limb. In the upper limb conservative surgery is less dangerous, gangrene not so common, and an artificial limb far less efficient; therefore indication to amputate is less common.

The opposite is true of the lower limb whose essential function is solidity; amputation is more frequently indicated here. Existence of bilateral lesions is in favor of conservation. Prolonged application of a tourniquet indicates amputation. The same is true when the wound is very badly soiled.

(c) Extrinsic factors: One is obliged to amputate more frequently in periods of great activity, because having the limb necessitates much more care of the case, which is impossible at such a time.

b. When is secondary amputation indicated?

In ischemic gangrene.

In septic gangrene, massive gas gangrene.

In certain deep gas phlegmons that spread rapidly.

In certain comminuted fractures with grave sepsis and secondary hemorrhage.

In purulent arthritis when expert treatment is without effect.

Perhaps sometimes in tetanus to do away with the toxin producing focus.

2. *Where must one amputate?*—The seat of the amputation is determined first by the nature of the injuries and secondly by prosthetic considerations.

a. Nature of the injuries:

(a) Primary amputation must as a rule be performed at the seat of injury and be as conservative as possible.

(b) Ischemic gangrene calls for amputation in healthy tissues at the limit of the lesion.

(c) In septic gangrene amputate in healthy tissues as low as possible. There are two exceptions:

I. When above the zone of massive gangrene there is one of superficial emphysema or bronzed erysipelas, one can amputate in the latter zone, provided the stump be treated so as to check the process.

II. When section in altogether healthy tissues would entail a much graver operation (subtrochanteric amputation of the thigh, instead of an exarticulation of the hip).

(d) In amputations for grave infections (shattered bones or arthritis), early secondary amputations, it is often advisable to amputate above the lesion in healthy tissues.

In late secondary amputations, on the contrary, one can often perform an atypical amputation at the focus of injury; one must take into account the fixing of the future artificial limb.

b. Prosthetic considerations are secondary; however, for each segment of a limb, there is a minimum useful length that ought to be preserved if possible. One must also think of the position of the scar.

3. How must one amputate?—

a. Anesthesia must be light; chloride of ethyl seems to be the anesthetic of choice.

b. Preliminary hemostasis: By elastic compression; by the digital compression of the main artery; by preliminary ligature of the main artery.

c. Mode of amputation.

(a) Atypical amputation:

I. Preliminary amputations—the necessary excision of the soft parts indicates the point where the bone must be cut.

II. Secondary amputations in a focus of suppuration; these are mainly late secondary amputations; cut straight through the seat of fracture or the joint, preserving flaps when possible. These secondary amputations often necessitate late corrective operations.

(b) Typical amputations in healthy tissues (gangrene, grave infection) less frequently primary amputations when the wound is very badly soiled.

I. In the first group of cases amputate by the circular method (preferably with a second section of the muscular cone) without suturing. Amputation by the method of flat section is not a method of choice but of necessity in cases where, the section is made in contaminated tissues (zone of extension in gas gangrene). It would be necessary otherwise to perform a graver operation (hip) or where there is a great interest to preserve as much as possible in order to be able to fit an artificial limb.

II. In the rare cases where one performs primary typical amputations, the circular method (most frequently) or the flap, or elliptical, method will be used according to the seat of amputation and the conditions necessary for fitting the artificial limb; primary suture may be used.

In all cases after treatment (continuous extension and dressings) is of great importance.

When there is much destruction of soft parts, especially those involving important nerves and vessels, amputation is necessary. Shock is by many considered a contraindication to amputation, but one should distinguish clearly between shock and hemorrhage. When shock is due to sepsis, amputate, as well as for uncontrollable hemorrhage. If the man is in true shock at the time of the operation this will kill the patient.

Be conservative in amputating. Amputations of the lower extremity are much more dangerous than those of the upper. It is hard to make a rule, but usually when from 12 to 15 cm. of a femur have been blown away it is best to amputate. The mortality is as high as 30 per cent in amputations of the thigh. Amputate when there is massive gangrene, but in local gangrene it is better to wait. Secondary hemorrhage is an indication for amputation, but it is never proper to amputate for tetanus.

WHERE TO AMPUTATE

One can amputate at the point of the lesion, but if the lesion is very high up in the thigh rather than do an articulation at the hip it is permissible to amputate through the exten-

sion of bronzed erysipelas if you treat the superficial condition. In general, however, it is better to operate in healthy tissue. Always amputate as low as possible when you get near the shoulder or hip joint. In amputations of the thigh immobilize your limb by extension with a weight of from 3 to 6 pounds. This has a tendency to take the pressure of the stitches off the skin as the pull is taken up on the skin above the amputation, and it also serves to keep the member quiet; there is always some amount of jerking of muscles after an amputation. In thigh amputations there is a tendency to reversion to the circular method and the wound is left open. Do not remove 1 c. c. of the periosteum to prevent the formation of osteophytes.

Secondary amputations are less often done in ischemic gangrene and in septic cases. We should amputate any grave septic comminuted fractures or purulent arthritis, especially the knee. Keep the calcaneum and the plantar surface of the feet wherever possible and always at least the femur and the hand. Never use chloroform as ethyl chloride is preferred. In hemorrhage, he saw 61 cases of injury to the femoral artery; 27 had to be amputated and 5 died. It is difficult to make rules for amputation because it depends on the art of the operator.

HOW TO AMPUTATE

As a matter of fact, amputation is generally done in shock, and for this reason these amputations are grave; 7 of 27 in his experience died. Never use lumbar anesthesia. He tried it and had to give it up. Under no conditions use chloroform. It is best to ligate the main vessels before amputating, but if not use a tourniquet. Primary amputations are really not amputations at all, but a shaping up of a limb; only the devitalized tissue should be removed.

Sepsis and gangrene make a serious prognosis. While the best method, as before stated, is the circular, they suture afterward and this diminishes the chance of infection. Flaps may be used, but they almost always are atypical. The surgeon who has only a few methods is not a real surgeon.

Army Sanitary School No. 133.

THE BACTERIOLOGY OF WAR WOUNDS

By Maj. W. J. Elser, M. R. C.

(Lecture to students of the fourth session, Army Sanitary School, at the central laboratory

The subject of wound bacteriology appears at first glance to cover a vast field but, fortunately for us, the recent advances made in the treatment of war wounds by the surgeons of the allied armies has greatly restricted this field. Moreover, the French and British bacteriologists have demonstrated that of the large number and variety of microorganisms which may gain access to a wound, only relatively few deserve serious consideration.

All war wounds are more or less contaminated by microorganisms derived in part from the skin and its appendages, in part from the soil and wearing apparel, and in certain instances from human feces. Experience has shown that the bacterial flora of war wounds varies in different sections of the battle area. Certain microorganisms occurring with great regularity in wounds acquired in certain regions are relatively rare in wounds acquired in other sections of the front. Conclusions drawn therefore from a study of wounds encountered in one sector must be applied with caution to wounds acquired in other areas, a fact which some investigators have apparently lost sight of. An exception to this rule is the tetanus bacillus. Owing to the rich, fertilized state of the soil in France, this organism is widely distributed, a fact which is not only supported by the results of animal experiments but by the very large number of cases of tetanus developing among the troops during the early part of the war, before adequate means for the prevention of this disease had been instituted.

Now while a very large variety of microorganisms may and do gain access to wounds only a certain number are capable of adapting themselves to the conditions prevailing, and this number may be still further reduced by prompt surgical interference. It is well known that many of the organisms found in nature are unable to thrive at body temperature or at temperatures approaching that of the body. These may therefore be disregarded. They

not only fail to develop within the wound, but soon succumb to the protective forces of the body. Others, and this includes many bacteria found in the soil, are incapable of thriving on the complex substances which alone are available as a source of food supply within the wound. These also may be disregarded, although the possibility must be borne in mind that associated microorganisms may prepare the ground, and thus permit of their development. Still other bacteria are incapable of developing in healthy living structures though they thrive well on dead or partially devitalized tissue. The fate of these organisms therefore is determined in part by the presence or absence of such tissue within the wound, and the result to the patient is determined by the disease-producing powers of the particular microorganisms concerned.

Finally, a relatively small number of microorganisms find suitable conditions for development within living tissue. The fate of these is determined in part by the number and the virulence of the organisms which gain access to the wound and in part by the number and the virulence of the local and general resistance exhibited by the wounded individual. Quite a number of these latter organisms are, however, of low virulence or wholly devoid of pathogenic powers and therefore of little practical importance.

While a review of these various single possibilities simplifies a comprehension of the problem which confronts us, it fails to consider the important part played by the interaction of two or several bacterial species; one species may favor the interests of another or they may work against each other, thus favoring the host. When we consider these several possibilities and the various reactions on the part of the infected host, one begins to realize the complexity of the processes going on in an infected wound.

Now, while it is true that all war wounds are contaminated with bacteria, a certain time must elapse before these organisms are able to establish themselves within the wound, before they are able to multiply and elaborate injurious agents in amounts sufficient to produce definite evidences of infection. For practical purposes, therefore, we may divide all wounds into two groups—fresh wounds, which, though contaminated, are not yet the seat of an infection and older wounds in which an infection has already been established. Wounds coming under observation less than six or eight hours after the incurrence of the injury as a rule belong to the former group, while wounds coming under observation at a later period are frequently the seat of an infection. It must be emphasized, however, that the periods here given are more or less arbitrary subdivisions. The time required for an infection to become fully established depends upon a great variety of factors and varies more or less with each individual case. In rare instances, a serious and virulent infection may be fully established within six or eight hours; in others, no definite evidence of infection may be apparent within 15 hours or even longer. As already indicated, this classification is made merely to meet practical ends. A microscopic examination of discharges from a fresh wound as defined above reveals very little information of practical importance and is therefore frequently omitted. The film made from such wounds shows a mixture of blood and serum intermingled, perhaps, with bits of muscle, connective tissue, and foreign material, but shows few leucocytes and, as a rule, no or very few bacteria. Cultures taken from such wounds yield a variety of microorganisms, some of the more important of which will be considered later. After the initial period, varying from 6 to 15 hours, the discharges begin to assume the characters indicative of infection. The polynuclear leucocytes become progressively more numerous, and varying numbers of bacteria begin to make their appearance. During the earlier periods bacillary forms predominate; later the cocci become more prominent. A culture taken during an early stage usually yields a large number of colonies and a varying number of different species. As the process of infection proceeds, some of the purely saprophytic microorganisms found in the early stages are eliminated and the more parasitic or pathogenic forms assume predominance. During the early periods the distribution of the bacteria within the wound is not uniform, and while this becomes partially equalized as the process of infection proceeds, it is important, particularly for the bacteriologist, to remember that in wounds showing evidences of healing different regions may again show a very different bacterial flora.

Of the aerobic forms commonly found in war wounds, the following may be mentioned:

Streptococci (usually the hemolytic types, the occurrence of nonhemolytic forms being relatively rare), staphylococci (both albus and aureus strains) enterococcus, *Bacillus pyocyaneus*, *Bacillus* of Friedlaender, *Bacillus cutis communis*.

Of these, by far the most important is the streptococcus. In fact, some French authorities claim that really serious infections develop only when this organism is present, either alone or associated with anaerobes. While this is in all probability an extreme view and is not endorsed by the majority of surgeons, all are agreed as to the paramount importance of the streptococcus in war-wound infections and practically all regard the presence of this organism in a wound as an absolute contraindication to its closure. Compared to the streptococcus, the remaining aerobes are of minor importance, although complications due to infections with staphylococci, *Bacillus pyocyaneus* and the bacillus of Friedlaender are observed. The presence in a wound of these latter organisms, however, is not regarded as an absolute contraindication to closure. The *Bacillus cutis communis*, on the other hand, is a harmless saprophyte occurring normally on the skin and usually appearing in wounds after the eighth or tenth day.

Of the anaerobes, a great many different species and varieties have been isolated from war wounds. Some of these have been definitely identified and represent organisms well known before the war. Others, occurring less frequently, still await identification.

According to Magrou, the *Bacillus aerogenes capsulatus* of Welch, referred to by the French as *perfringens*, is encountered either alone or associated with other anaerobic forms in about 75 per cent of the wounds. According to the same author, the *Bacillus sporogenes* is next in order of frequency, occurring in about 30 per cent of the cases, but almost invariably associated with the preceding or other anaerobic forms. The *Vibron septique* occurs in about 20 per cent of the wounds, but owing to its slow development and its limited growth in culture media, has apparently escaped the attention of many investigators. Apart from these, a large number of other anaerobes have been encountered by different observers, but the exact significance and importance of these organisms is still under discussion. As already stated, quite a number of these organisms still await identification.

While gas bacillus infections played an important part in the early periods of the war, the remarkable advances made recently in the surgical treatment of wounds, coupled with the improvement in the transportation facilities, permitting of early surgical treatment of the wounded, have greatly reduced the number of such occurrences.

Concerning the significance of anaerobes in wounds, the opinions of surgeons and bacteriologists vary. It appears to be a fact that the mere presence of these organisms in a wound does not lead to the development of gas gangrene. This may be attributed in part to wide differences in point of virulence exhibited by members of the same or different species and in part to the fact that dead or devitalized tissue, blood clots, etc., appear to be essential for the successful anaerobic development.

According to some authorities the clinical features exhibited by the case are of prime importance in estimating the significance of anaerobes in the wound. In the absence of all signs of gas bacillus infection, they attach little importance to the presence of these organisms, the inference being that when they fail to call forth the usual reaction on the part of the host they represent nonvirulent forms. However, such cases must be watched with the greatest care. Others attach more importance to the presence of anaerobes, the degree being determined in part by the location of the wound. Favorable sites for the development of gas bacillus infections being the fleshy parts of the buttocks, thighs, and calves of the legs. The degree of mutilation of the parts, the degree of shock and exsanguination, the degree of impairment of the local blood supply, the presence or absence of fractures, the character and number of associated organisms are all factors considered by them in estimating the significance of anaerobes when present in a given wound.

As I have already stated, some authorities (Tissier and his followers) advance the view that serious infections develop only when streptococci, either alone or associated with anaerobes, are present and that all wounds which do not contain streptococci can be closed with safety. Duval, on the other hand, has observed serious infections developing in partially closed wounds containing only anaerobes associated with nonpathogenic aerobic forms and fatal cases of gas gangrene in which the wound failed to reveal the presence of streptococci are recorded in the literature.

In view of the uncertainty still surrounding this subject, it seems wise to consider the presence of anaerobes as of serious import until our own personal experiences are sufficient to permit us to pass on this question.

Since the bacteriologist at the front works in conjunction with the operating surgeon and since the mode of procedure to be adopted in a given case rests upon the combined experiences of the operator and the bacteriologist, it will be necessary in what follows to enter the realm of surgery, to make clear the exact functions of the laboratory in connection with this particular phase of the work. Whoever undertakes this work must be thoroughly aware of the great responsibility which he assumes. Anything in the nature of a perfunctory examination of a war wound must be avoided. A superficial or careless bacteriological examination may lead to errors resulting in very serious consequences to the wounded man.

As I have already indicated, a fresh wound, according to the terminology adopted, is one that is contaminated but not yet definitely infected. It is in connection with such a wound that the question of the feasibility of a successful primary closure arises. Since a microscopic examination of the discharges in a fresh wound as a rule yields no information which might be of value in deciding this question, the decision rests entirely with the surgeon. Time permitting, cultures should be taken either in the course of the operative procedure or after the wound has been thoroughly cleansed and all foreign bodies and devitalized tissues have been removed. If, after the lapse of a given time, the cultures reveal streptococci the wound should be, according to some authorities, immediately reopened, while if the cultures show only anaerobes and no streptococci the practice of different surgeons varies, as already indicated. If large amounts of material are employed for cultural purposes, the bacteriologist is often in a position to demonstrate the presence of streptococci within six to eight hours and with a view of arriving at an early diagnosis, such culture should be examined early and at frequent intervals thereafter.

When the closure of a wound is deferred, the work of the bacteriologist becomes of the greatest importance because it is in this type of case that the laboratory findings must determine the treatment to be adopted. Every such wound should be made the subject of a thorough microscopic and cultural investigation. Since, in the beginning, the organisms may be very unequally distributed, such an examination should not be confined to a restricted portion of the wound. Particular attention should be paid to the regions which have harbored foreign bodies, and material from all pockets and recesses should be gathered for such examinations. If streptococci are found, the wound should not be closed until their complete removal by one means or another has been accomplished. At least two negative cultures for streptococci on successive days should be secured before the closure of such a wound can be recommended. In the absence of the streptococcus the question of closure depends in a large measure upon clinical experience and judgment. Special care should be exercised in wounds involving the fleshy parts of the buttocks, thighs, and calves when anaerobes are found. The presence or absence of fractures, the type of fractures, the condition of the local circulation, the general condition of the patient, all must be taken into consideration. As already stated, the closure of wounds over organisms other than the streptococcus and the anaerobes may lead at times to disagreeable and even serious consequences.

In wounds which enter the hospital in a serious state of infection, or in which such a condition develops subsequently, the Carrel-Dakin method of treatment is frequently practiced. Here it is the duty of the bacteriologist to determine by daily or less frequent microscopic examinations of the exudate the numerical evolution or involution of the bacterial flora. While such determinations furnish some idea of the progress of the case, it is not the number but the type of organism in the wound which is of prime importance. These numerical determinations which were relied upon originally to decide when a wound was ready for secondary closure are now supplemented by cultural investigations. When streptococci have once been demonstrated in a wound, two consecutive negative cultures must be secured before secondary closure of the wound can be practiced with safety. It may be well to repeat here that in making these cultivations material should be gathered from many different points in the wound since experiments have shown that streptococci may be absent from the greater part of the wound surface yet present in certain restricted

areas. This fact probably explains partial failure attending secondary closures made after cultural examinations for streptococci yielded negative results. Moreover the viability of these organisms seems to be reduced as healing supervenes in the wound. To secure reliable results at this stage of the process, media especially suited for the development of the streptococcus should be employed. The addition of so-called enriching fluid, horse serum or ascitic fluid, to the culture media is advisable for the same reason. A persistently high bacterial count suggests defective technique in applying the treatment or the presence of foreign material or dead bone within the wound, and under these circumstances secondary closure should not be attempted. In view of the relative innocuousness of many of the organisms found in older wounds, cultural investigations to establish the disappearance or absence of pathogenic forms should be undertaken early. Much valuable time may thus be saved to the patient.

In the preceding pages I have attempted to give a brief outline of the more important points bearing on the subject of wound bacteriology. I have said nothing about the peculiarities of the organisms recovered from war wounds nor about our methods of isolating and identifying these bacteria. These are matters which only concern the professional bacteriologist.

The treatment of gas-bacillus infections by means of specific antitoxin sera has also been omitted. Such sera have given favorable results in experimental infections in animals, but their value in the treatment of gas-bacillus infections in man remains to be established. The prophylactic value of these sera is now being tested by some of the allied forces.

Thus far, I have referred to the tetanus bacillus only in connection with other organisms which may gain access to war wounds. That this organism frequently gains access to wounds is amply borne out by the experience gained in the early part of the war, and we now proceed on the assumption that every war wound—and this includes even trivial wounds, such as abrasions occurring in connection with trench foot and frostbites—is very apt to be the seat of such infections. Fortunately, we are in possession of an efficient antiserum which when properly used protects the vast majority of individuals against serious consequences resulting from infections with this organism. This serum, as you know, accomplishes its results by neutralizing toxic products elaborated by the tetanus bacillus. It does not exert a destructive action on tetanus spores and it remains in the system for a relatively short period, from 10 to 14 days. If, therefore, the germination of the tetanus spore is delayed beyond this period, tetanus may develop although prophylactic injections of tetanus antitoxin have been administered. It is because of this possibility that at least two injections at intervals of one week should be given. The advisability of giving even a greater number of injections should be considered in all cases of very severe injury followed by prolonged suppuration and attended by much necrosis of tissue. Experience has also shown that tetanus is apt to develop, following secondary operative procedures undertaken after the tetanus antitoxin has been eliminated from the system. It is recommended that all cases subjected to secondary operative procedures should be given a protective dose of antitoxin serum if more than seven days have elapsed since the administration of the preceding dose. By adopting these precautions the incidence of tetanus in the British Army has been reduced to the point where this disease can no longer be regarded as a serious war problem. Tetanus, however, has not been entirely eliminated. This may be due to the fact that tetanus spores have in certain cases remained dormant for an unusually long period and have germinated after the protective agents introduced into the system have been eliminated, or to the fact that in some cases the administration of antitoxin was unintentionally omitted, or, finally, to the possibility that certain members of this group of organism produce a toxic agent which is not neutralized, or not completely neutralized, by the antitoxic sera now in use. Captain Tulloe, of the British Army, has shown that at least three serological types of tetanus bacilli exist, but whether these types produce the same or different toxic agents has not been established as yet.

In conclusion, I wish to say that the information here presented has been secured from the various French, Belgian, and British authorities active on the various fronts. To assign to each one the exact part played by him in clarifying this subject would be difficult or impossible. It is for this reason that I have refrained from quoting the various sources of my information.

Army Sanitary School No. 134.

MILITARY DERMATOLOGY

By Capt. H. A. MacGruer, M. R. C.

In considering the skin, one must not forget that it is an important organ intimately connected with and influenced by all the various bodily functions. It should be borne in mind that one of the most important functions of the skin is protection, and that a healthy epidermis with its various layers intact defends the body against the invasion of all kinds of organisms. It has been well said that "The stratum corneum is the first line of defense of the skin." Skin diseases are the cause of the greatest wastage in our Army at present.

"Every man incapacitated from duty—it matters not by what means—is a gain to the enemy. From the point of view of the Army, and of military efficiency, those diseases ought to rank highest in importance which cause most casualties. Judged from this aspect diseases of the skin occupy one of the premier positions, for under the conditions of trench warfare it is inevitable that they are met with in large numbers. The exact extent of the wastage for which they are responsible is known only to the authorities, but it is apparent to all that since many are contagious, successful efforts directed toward prevention and cure will amply repay by a very large gain of fighting men."—McCormac.

A dermatologist accomplishes a real economy by returning men suffering from skin diseases back to the front in the shortest space of time. The skin department not only relieves the surgical department but safeguards it from contamination from such contagious skin diseases as occur. The general practitioner is only too glad to disclaim any great knowledge of skin diseases, and this holds equally true with the volunteer Army surgeon.

There is a general belief that skin diseases as a whole are indicative of filth and uncleanness, and no one can deny that they are contributing factors in some of the cutaneous eruptions. These factors naturally tend to make the distinctly parasitic affections more numerous. It is not necessary to enumerate the large number of diseases that might be placed under the etiologic heading of parasites. We are particularly interested in the prevention and cure of pediculosis, scabies, impetigo, ecthyma, furuncle, and other infectious skin diseases common in our Army. We know positively that this can be performed under ideal conditions, but we are not at present working under ideal conditions, and will therefore have to perform unlimited labor to accomplish the results necessary. Our first and, undoubtedly, our greatest task is to prevent these diseases, and this is a task which calls for the hardest and most persistent kind of work. The officers and medical men of the armies of other countries, all working for the same end, efficiency, have accomplished wonders. We, starting at what might be termed the nucleus of our great Army, should profit by the mistakes of others and their thorough investigations, and should institute such prophylactic measures as will insure us an army of men capable and efficient and unencumbered by often unnecessary conditions which increase discouragement and lower self-respect, vitality, and efficiency.

Among the prophylactic measures necessary to prevent the many skin lesions which have been so prevalent in the Army, cleanliness is of the first importance, and by cleanliness I mean regular bathing and disinfestation. The medical officer can not order the men to bathe, nor can he himself always see that facilities for bathing are established, but by virtue of his knowledge of the results of lack of bathing as well as the relations he should establish between himself and the commanding officer, he should by every proper means bring to the attention of the latter the full realization of the decrease in skin diseases possible through regular baths and the consequent marked gain in the efficiency of the company. All officers take pride in their men and organizations and are anxious to have them physically and mentally fit for whatever duties they may be called upon to perform, and with proper cooperation between the medical officers and the commanding officer much of the necessary prophylaxis can be accomplished. I said prophylaxis because this is the first duty not only of the medical officers but of all officers and men. The greatest prophylaxis we have at present against the great majority of lesions of the skin is cleanliness. It is not probable nor is it possible that we will be able to carry out measures in the front line that will keep the bodies of the men clean enough to ward off these pests, but preparations are being made which will insure a great lessening of all the conditions which give rise to so many skin lesions and consequent bad condition, lost time, and lowered efficiency.

Provisions have been made to preclude such infestation of lice and scabies as has been common during transportation of troops to Europe. Special efforts are now being made to see that all commands are clean and free from infestation before embarking. Disinfestation of quarters and blankets on shipboard is now provided for. Such supervision of personal hygiene on shipboard as will insure continuous bodily cleanliness and adequate clean under-clothing has been called for by request of the chief surgeon. The chief quartermaster has, with approval of the chief surgeon, arranged a more logical supervision of the facilities for bathing, laundry work, and disinfestation. The Quartermaster Corps, upon recommendation of the Medical Corps, has purchased several Thresh horse-drawn disinfectors and several Fodden-Thresh steam-propelled disinfectors. This apparatus has been or is being distributed under direction of the Medical Corps.

General Order 38, general headquarters, A. E. F., 1917, paragraph 2, "authorizes for each battalion area a bathhouse approximately 26 by 22 feet, with a concrete floor, containing a dressing room and a bathroom with from 8 to 12 shower heads, together with the necessary arrangements for heating the same."

General Order 13, general headquarters, A. E. F., 1918, paragraph 5: "Organizations moving into the zone of the advance will take with them their portable shower baths, to be installed in suitable shelters, with the least possible delay after arrival. Engineer troops, when available, should make the necessary installation."

General Order 11, general headquarters, A. E. F., 1918, Paragraph IV., subparagraph 2, deals at great length on the prevention of trench foot and states that "the occurrence of this condition among the troops of a command is an indication of a lack of good sanitary discipline. Organization commanders are directly responsible, and by constant personal observation and supervision will satisfy themselves that the facilities are available, and that the members of the command are making full use of the opportunities afforded thereby. The commanding officers of all units will be held personally responsible that means for prevention enumerated in General Order 11 are carried out under the personal supervision of a commissioned officer."

I have mentioned these general orders to impress upon you the fact that general headquarters fully realizes and appreciates the great importance of preventing, as far as lies in their power, the several skin diseases to which the soldiers of this war are subjected.

It is very unsatisfactory to cleanse men by baths if they have to put on unclean, vermin-infested clothing afterwards. Bathing and changing to clean clothes will not only prevent the infestation of lice and relieve the soldier of his very friendly and persistent pests, but will also probably prevent many of the other annoying conditions of the skin; such cleansing not only removes infectious material already present but, by giving the skin the proper resistant power, will prevent infection from other sources.

In addition to causing severe irritation of the skin by their bites, lice carry the virus of typhus fever, relapsing fever, trench fever, and possibly other infectious diseases, from man to man; and when we receive reports from such men as Peacock, who has made some very thorough investigations, that 95 per cent of the men examined who have been in the front area for six months are infested with lice, it makes us realize the great importance of prophylaxis.

The louse is a parasite which is utterly dependent upon man's blood for its sustenance and man's body and clothing for prolonged prosperous longevity and reproduction. The home of the body louse is under the folds of the clothing. Eggs are found chiefly at the fork of the trousers, trousers generally, arm pits, shirt seams, and the neck, but louse eggs have been found in almost all parts of the clothing, even the pockets, the cloth identification tag tape, and the cloth articles of Catholic devotion. Eggs of the body louse are found also on the hair of the axilla and pubis. All a louse seems to want or need is warmth, humidity, and shelter.

We must consider then, first, the measures for promoting personal cleanliness among the troops generally and freeing from vermin those who have become infested; second, measures for freeing clothing from lice and their eggs; third, measures for keeping billets clean.

I. All troops should be inspected at least once a week; in this way not only lousiness may be detected and specially dealt with, but also many other conditions which if treated in their incipency may prevent the spreading of disease. Troops should be required to

bathe as soon as practicable after leaving the trenches and should be required to bathe at regular intervals, at least once a week, while in rest, reserve, or support. The hair of the head, axilla, and pubis should be cropped close. For head louse, petrol, or white precipitate ointment, chloroform, or vinegar will soften the nits so that good soap and water washing will complete the cure. For pubic lice gasoline applied two or three times will usually eradicate the pest, or a prescription of yellow oxide of mercury 10, acid salicylic 1, vaseline 90.

II. All underclothing, shirts, drawers, socks, and tapes should be thoroughly disinfected and washed. Clothing, if in large quantities, should be disinfested by whatever apparatus is available for that purpose—dry heat, steam, or boiling. By the Thresh horse-drawn disinfector it has been found that the garments should be steamed at 215° F. for 45 minutes. With the Fodden-Thresh they should be steamed at 220° F. and 5 pounds pressure for 30 minutes. If clothes are boiled in water for five minutes, lice are killed and eggs destroyed. A thorough ironing of garments, particularly along the seams is very efficient, but very slow. Blankets should be treated either by heat in a Thresh oven, sulphurous acid, by use of the Clayton machine, or, when these are not available, soaped in a hot 3 per cent solution of cresol in water and afterwards rinsed thoroughly in cold water and dried. In using the Thresh or Fodden-Thresh disinfestors it is necessary that certain conditions be carefully observed. Articles should never be packed tightly or rolled up into bundles, but should be loose and so arranged that steam will have access to all surfaces. Sufficient steam pressure and sufficient time for exposure are also necessary.

III. Billets should be sprayed at short intervals with 5 per cent cresol in water or naphthalene. Straw should be changed as frequently as possible and the old straw burned, although it has been proved that dugouts and billets are not important sources for disseminating disease. On the other hand, it is very inefficient to delouse one half of the troops and then allow them to mingle with the other half, as pediculosis is very largely spread by the infected individual. Spraying the clothing with the various solutions as a preventive is not always a benefit, particularly if the substance used is volatile and does not last long enough to prevent the ova from being hatched; under normal conditions ova hatch in from 7 to 12 days, but this may be delayed for a much longer period. Cresol, 1 to 1,000, added to 1 to 1,000 formalin will kill lice and nits on clothing in two hours if clothing is soaked in this solution. Treatment of the underwear with various solutions, such as carbolic, cresol, etc., has been tried, but as yet no satisfactory results have been obtained. The N. C. I. powder of the British (naphthalene 96, cresote 2, iodoform 2) has given excellent results in prevention when properly used, but the soldier will not persist in its use and, in fact, throws it away. Gunn, R. A. M. C., claims that dipping the underclothing in a parasiticide solution composed of 1½ ounce, each, of naphthalene and sulphur in 1 gallon of benzol or petrol has afforded complete protection against the body louse. In all these matters we must consider efficacy, rapidity, practicability, and cost.

The British forces have adopted the dry heat method of disinfesting clothing and equipment. They have found that the ironing method, steam, etc., is not as efficient as the dry heat. Captain Jacobs, R. A. M. C., has carried out experiments and constructed an apparatus which has proven most efficient and has many advantages over others. Experiments have shown that in lousy clothing hung in a hot-air chamber or a chamber heated to 60° C., the lice are dead after 10 minutes. Tests have also been made to see what, if any, ill effects this might have on articles of clothing or articles commonly carried in the pockets. Rubber articles were also tested. It was found that no appreciable deterioration took place. It was then recommended that delousing chambers be established in connection with baths, and a permanent staff attached. About 1,450 men could be bathed and their clothing disinfested by one apparatus and staff each day. The construction of this delousing chamber is not difficult, the materials are not scarce, and although the buildings are not strictly portable they are so simple in construction that they are easily taken down and reconstructed. Personally, I think this is the nearest to an ideal method that has yet been devised. Clothing and equipment is not injured in any way and in fact comes out of the chamber dry and in much better shape than when steam is employed.

Scabies is another one of the contagious diseases so prevalent in the Army; in fact so important are scabies and pediculosis with the resulting pyodermias that the actual loss of

time of our soldiers is becoming a serious matter. McCormick reports that in one hospital where he had seen a great many cases of the resulting pyodermias, and had averaged the loss of time of the men in that hospital alone, such average loss had been 31.67 days per man. This did not take into consideration the time spent in other hospitals nor the time consumed in coming back to the hospital. Scabies is due to an animal parasite, the *Acarus scabiei*. It is contagious to a marked degree and, knowing this, it is readily seen how easily it is contracted, how readily communicated from soldier to soldier under the present living conditions, with the men sleeping together and using the same blankets and with the natural flocking together and intimate contact. The eruptive lesions are the result of the reactionary inflammation provoked by the presence and products of the parasite in the cutaneous tissue. Papules, vesicles, and blebs result and purulent lesions are produced, due to secondary inoculation of pus cocci. The constant scratching gives rise to favorable opportunity for integumentary coccus infection. The female mite is the one which invades the integument. The mite burrows into the skin and deposits its ova and finally perishes in the skin, so that the burrow contains the mite, its excreta and ova. Itching, particularly when the patient warms up in bed, is one of the chief symptoms, although many of the soldiers are occupied with other matters of graver importance and do not notice the itching and many do not report the scabies, as they attribute the itching to pediculi; so in a great number of cases impetigo, ecthyma, boils, and other pyodermias develop which could have been avoided by early diagnosis and treatment. The men should be inspected at least once a week and the examination should be thorough, not merely a glance at the interdigital spaces, wrists, etc. The soldier should be stripped. In this way not only scabies but other skin conditions will be discovered early and the spreading of disease prevented.

But little difficulty need be experienced in the diagnosis of this disease in uncomplicated cases. The distribution, multiformity of the eruption, and the burrows are diagnostic points. One of the sites usually selected is between the fingers and other parts of the hand and on the wrists; however, it is not necessary to find the lesions on these parts and those duties give them opportunity to wash often and care for themselves, as bakers, laundry and oil workers, are free from lesions here. So lesions on hands are often absent and vesicles are more common than burrows. Other sites are about the elbow joint, axilla, umbilicus, lower abdomen, genitalia, anus, buttocks, lower calf, back of knees, and at times the feet. The burrows usually resemble a thin line one-fourth to one-sixteenth inch long, with generally a pinhead-sized vesicle near the end. Many times the mite can be seen, if one is expert and has good eyesight, or uses a magnifying glass. It is found in the blind end of the burrow, where it reposes as a grayish or grayish black dot. If scabies is complicated with impetigo the burrows are more difficult to find. In these cases the hands and feet particularly are the seat of vesicles and perhaps bullæ, crusts, erosions, and inflamed burrows and even ecthyma. In eczema complicating scabies we find red, rough, eczematous areas, either dry or moist, on the hands, arms, thighs, or trunk. Scratching and severe treatment of scabies (overtreatment and sensitive skins) is at times responsible for an eczematous condition. Some cases of impetigo may be severe enough to mask scabies; these secondary impetigos are especially found on the lower part of buttocks, elbows, and knees. Boils are pyodermic complications at times. The chief points of differential diagnosis between scabies and pediculosis are as follows:

Location	
SCABIES	PEDICULOSIS
Hands, wrists, elbows, anterior axillary folds, umbilicus, abdomen, buttocks, knees, penis.	Posterior axillary folds, shoulders, clavical region, upper part of buttocks, groins, thighs, between knees and ankles.
Types of lesions	
Burrows, vesicles, small superficial crusts, papules, pustules, specific erection of the pilosebaceous follicles, scratch marks represented by minute blood crusts at the orifices of the erected follicles.	Superficial and deep pustules with a surrounding red halo; linear impetigo; lesions on the whole much larger than those seen in scabies.

Next to prophylaxis the early diagnosis of scabies, which is made possible by the weekly inspection of the men by competent medical officers, is of the utmost importance. As in the treatment of pediculosis, so in scabies, thoroughness is absolutely necessary. It is a great saving to cure cases by being thorough in the first treatments and not have the soldier return and thereby lose double time. It is not a disgrace to have scabies, although it may become so to keep them if proper remedial measures are supplied.

In the treatment of scabies the bath is a necessity; tub baths have the preference, although with proper thoroughness showers will answer, and showers are what will be used in the Army. Trained men should be at the baths to treat scabies, not only to see that treatment is carried out properly, but to see that the cases are not overtreated and to discover lesions of other diseases. Scabies, in a great percentage of uncomplicated cases, can be cured in one treatment, and if all cases could be diagnosed early it might not be difficult not only to cure the present cases but very greatly to reduce the number of new ones. This again brings up the great necessity of having proper arrangements made for the bathing of the men and thorough disinfection of their clothing, blankets, equipment, etc. In many of the French hospitals I have visited the medical men claim to cure over 90 per cent of scabies cases in one treatment; that is, in one bath and one rub of ointment, and while the patient is being treated the clothing is disinfected and the patient is returned to duty the next day. Vapors have been recommended for treatment of this condition but they do not penetrate nor do they kill the mite nor destroy the ova. Lotions require great skill and necessitate more time and are therefore not as efficient as ointment.

The plan of treatment as adopted by the United States Army for the treatment of uncomplicated scabies is as follows:

The patient, usually with the assistance or under the supervision of a trained assistant, thoroughly applies green soap to all parts of the body except the face, giving special attention to those areas chiefly affected. The thorough and proper application should take about 15 to 20 minutes. Some use a stiff brush for this purpose; it may bring blood, and although it may relieve the patient of the itching, still my personal opinion is that it is not necessary to be so severe. A coarse towel or glove or even the bare hands with the soap is sufficient to remove all dirt, grease, and dead epithelium and open up the vesicles and burrows. After the 15 to 20 minutes the patient is put in the tub, or under the shower of hot water, where he continues to rub himself vigorously with soap. One of the best helps is a roll of felt or very heavy coarse cloth about 6 inches long and an inch in diameter; this the patient uses to rub between the fingers, thus breaking vesicles and opening burrows. After the bath the skin is dried and, except upon the face and scalp, the following ointment is well applied for 15 or 20 minutes: Potassium carbonate, 10; sulphur sublim., 20; adipis (or vaseline), 80. The ointment is again applied that night, as the pajamas or clothing have received some benefit and the skin robbed of that much. The next day, if the skin has not reacted severely to this treatment, the patient is again rubbed with the ointment. If a slight irritation has developed, then a 10 per cent sulphur ointment is used. This treatment will last the patient till the next day when the final application is made. This is a repetition of the 10 per cent sulphur ointment. After this the patient is given another bath and receives his clothing, which has been disinfected by the same methods as advised for pediculosis. In handling these cases care should be exercised to keep the new cases from infecting and re-infecting those who have been treated. In some cases a dermatitis may develop from the treatment of scabies with sulphur; so exercise care, take an interest in the cases, and do not make it too much a matter of routine treatment. In these cases of dermatitis which develop from sulphur, use zinc-oxide ointment containing cornstarch and also about 1 or 2 per cent ichthyol; or a bath with 1 cupful bicarbonate of soda and 2 cupsful cornstarch in tub of warm water, the patient to remain in tub for 20 minutes and afterwards pat himself dry. Other treatment may be by Carriers "water paste," zinc oxide, calcium carbonate, aqua calcis, glycerin aa, and applied with a soft brush, or 1 or 2 per cent phenol solution if itching severe and skin not too greatly inflamed; or coal tar solutions. Albuminuria, which is seen in a small percentage of scabies cases, occurs only when there is secondary infection and is not a contraindication to treatment by sulphur ointment.

Primary as well as secondary streptococcus and staphylococcus infections of the skin are exceedingly common. They are termed pyodermias. The staphylococci infections are important; they are invaliding many able-bodied men. H. G. Adamson divides them as follows:

(1) Sycosis menti and similar affection of their hairy parts, namely, the upper lip, eyebrows, eyelashes, scalp, pubes, axilla.

(2) Chronic furunculosis.

(3) Chronic eozematoid impetigo of the trunk and extremities.

The majority, probably all, of these cases could be avoided were the initial skin complaint correctly diagnosed and efficiently treated. These staphylococci infections may all be included under one term, impetigo of Boeckhart. Many times this condition arises as a secondary complication of contagious impetigo of Tilbury Fox, Sabouraud, in 1900, first clearly demonstrated the distinction between the two groups of impetigo. Contagious impetigo of Tilbury Fox is due to the *Streptococcus pyogenes*; it is highly contagious. It first starts as a superficial blister, which contains clear serum and which rapidly dries into a crust; the crust is amber colored and looks as though it were stuck on. This drying and scabbing process is, many times, so rapid that the vesicle is unobserved. On removal of the crust (with forceps) there is found a superficial erosion, with an overhanging fringe of the horny layer of the epidermis; this is the floor of a broken blister. This disease attacks the chin and cheeks, sometimes from infection in barber shops. It also occurs on the trunk, limbs, and other parts of the body as a complication of scabies and pediculosis. This form of impetigo is easily cured and still, because of lack of early diagnosis and proper treatment, from this condition arise most of the staphylococci infections, sycosis, furunculosis, and chronic impetigo, which may be well termed the impetigo of Boeckhart, and which are most stubborn and very difficult to cure. These staphylococci infections are deep-seated lesions and lead to the formation of pockets of polynuclear leucocytes or pus cells, deep in the tissues around a hair follicle. These lesions may be small and closely set on some hairy region, or they may be larger and scattered over the trunk and limbs (as in furunculosis). Remember then that most of these incurable or stubborn staphylococci infections of the skin arise as a complication of uncured impetigo contagiosus (*Streptococci contagious impetigo* of Tilbury Fox). These infections are the cause of stubborn sycosis, which is not necessarily limited to the beard region but attacks the eyebrows, eyelids, scalp, axilla, and pubes, and it also is the cause of furunculosis, which may affect the skin of the neck, trunk, or limbs.

Then we have that type of case where the patient has scabies complicated by turbid vesicles on the hands and feet, and crusted patches on the limbs and trunk. On the buttocks a severe type is often seen in which the erosion is converted into a shallow ulcer with an inflamed base, with or without a dirty brown crust. Most of these cases of impetigo complicating scabies yield to the sulphur ointment treatment for scabies. Those not treated early and thoroughly may later develop boils or the scratching may convert them into eozematized impetigo, with eczematike, infiltrated itchy, crusted areas on the limbs and trunk; these cases are exceedingly rebellious to treatment.

In treating impetigo the first procedure is to remove all crusts and every overhanging blister margin by mopping with hot water, vaseline, or sweet oil. This procedure must be done two or three times daily and must be very thorough; at times it is necessary to remove crusts by picking off with forceps or pieces of cotton or gauze. When the skin has been cleared of the crusts, etc., then apply Ung. (hydrarg. ammon.) 5 per cent or swab the area with 20 per cent solution of silver nitrate and afterwards apply talcum or cornstarch.

The treatment of the staphylococci infections of the skin is much more difficult. Vaccines are well worth using in sycosis, furunculosis, etc. Shera, R. A. M. C., claims 100 per cent cures of chronic cases of trunk with autogenous vaccines, while Adamson claims the treatment by vaccines has not proved the panacea it was said to be.

These chronic cases should not be handled except in special hospitals or wards, and here facilities for making autogenous vaccines will undoubtedly prove of real value. It is possible by complete depilation with X rays to produce what at first appears to be a cure, but almost always the disease relapses as soon as the hair grows again. If the disease occurs only on a small area, depilation with forceps and the application of antiseptic ointment will usually

effect a cure. Pure carbolic acid carefully applied is often of benefit. In the treatment of furunculosis a most thorough examination of the patient is demanded; the urine should be examined and the general condition of the patient taken into consideration. Tonics and care are of benefit. Stock vaccines are at times beneficial, and autogenous vaccines have given most satisfactory results. Baths, mopping the skin with antiseptic lotions, and sterilization of clothing are prophylactic measures. Carbolic acid and a very small applicator (toothpick, match, etc.) inserted into a boil will destroy and remove infection; this is not painful, carbolic acting as a local anesthesia. If it is necessary, the application of alcohol may follow the carbolic; this will give immediate relief. Ecthyma is best treated by hot applications of boracic acid packs over a period of an hour, three times a day, until ulcerations are clean, then using 1 per cent picric acid; ichthyol ointment 10 per cent, or, when healing slowly, using silver nitrate to stimulate 4 per cent salt. Send to division dermatological hospital.

The treatment of chronic eezematized impetigo is very unsatisfactory, as it is so often a sequel of scabies complicated with impetigo contagiosus and is not properly treated in the beginning. Itching and scratching keep up eczema and adds new pustules and boils. The use of X rays or the following prescription is beneficial: Acid pyrogallie gr. I in 1 dram of zinc oxide.

The early diagnosis and proper treatment of streptococci impetigos is the only sure method for the elimination of these obstinate and often incurable staphylococci infections, as the latter follow as a sequel to the initial and more easily overcome streptococci diseases.

There are other lesions of the skin which you will see in the Army and, although of importance, they will necessarily be treated at skin hospitals: Seborrhea, psoriasis, urticaria, etc. I have endeavored to acquaint you, as far as possible in a lecture, with the most frequently met with skin conditions and sincerely trust these few points will be of value. Familiarize yourselves particularly with the differential diagnosis and treatment of scabies and pediculosis. Be thorough in treatment and in disinfection. Get the reputation of having the skin of the men clean and healthy and you will have performed one of your most important duties.

Army Sanitary School No. 135.

FOOD CONSERVATION AND THE MEDICAL OFFICER (Abstract)

By Capt. Walter H. Eddy, S. C., N. A., August 6, 1918

1. The problem of food conservation in the Army is essentially different from the civil problem. As some one has put it, our job is "to see that the food gets into the belly of the man and not in the garbage pail." I do not wish to burden you to-day with statistics, but a few figures will help to point the necessity for increasing attention to this Army problem.

Weight of the garrison ration, 4 pounds, 3 ounces; bought in France, 1 pound, 3 ounces; by ship from the United States, 3 pounds of actual food, to say nothing of containers. This means 3,750,000 pounds per day, or 1,875 tons. In a year this will amount to 673,800 tons, or one 5,000-ton ship every two or three days.

Potatoes: Refuse and waste as ordinarily peeled, 25 per cent; refuse if carefully peeled, 13 per cent; unnecessary waste, 12 per cent. Ration is 1 pound per man per day, or 1,250,000 pounds \times 12 per cent = 150,000 pounds per day, or enough to feed 150,000 men.

Garbage waste (edible): Should not exceed 12 per cent per day. This results in reducing the value of the ration from 4,200 to 3,696 calories per day.

These figures at least illustrate the fact that small wastes multiplied by the size of the Army are not negligible items, considered either from the viewpoint of money, transportation, or nutrition.

2. The work of detecting waste and instituting measures for its remedy falls directly upon the medical officers of the organizations. As sanitary inspectors they are the men most cognizant with the mess conditions, and it is for that reason that I wish in what follows to consider this problem in terms of the medical officer's duties and responsibilities.

3. To illustrate the relation of the medical man to the problem, let me develop one concrete example—the question of the beef component.

The ration allowance of fresh beef is 20 ounces, and this component is usually issued as 70 per cent beef and 30 per cent bacon or other substitutes. This means 14 ounces of fresh beef per man per day, or approximately 875,000 pounds of fresh beef issued in quarters to the Army every day of the year as a minimum. Beef is now quoted in the United States at 22.5 cents a pound, and this little item then represents \$196,875 per day for beef alone, leaving out of consideration all cost of shipment. One per cent waste then gives us about \$2,000 a day. A little development of your imagination will suggest the significance of these amounts translated into terms of finance, transportation, space robbed from troops, ammunition, and the like.

Looked at from another angle, the Army ration distributes its nutrients as follows:

	Protein	Fat	Carbo- hydrate	Calories
	<i>Grams</i>	<i>Grams</i>	<i>Grams</i>	
Ration.....	146	147	544	4,200
The beef component.....	60	60		

We certainly can not afford to waste this component either from the viewpoint of money value or as protein producer.

Now in this matter of beef conservation you play a most important part. You are the gentlemen whose judgment decides the fate of much of our frozen beef. You are charged with the health of the men and also with the prevention of useless waste of Army property. It is also true in the past that large quantities of beef have been condemned by medical officers and buried or burned, a large portion of which might have been saved by careful trimming. We have ourselves during the month of May salvaged at Dijon 75 per cent of 35,000 pounds of beef that had been condemned and returned to the freezer. That 26,000 pounds of beef should have been trimmed out and issued to the troops and would have saved not only beef but valuable transportation space.

Beef is now shipped frozen from the States. At St. Nazaire it is loaded into insulated cars and travels to the nearest refreezing station, usually Gievres or Dijon. From here it is put into box cars and goes to the organizations as rapidly as possible. It is obvious that with all the delays possible in transit, the chance for partial thawing and surface decomposition is great. But the fact remains that our aim should be to see that as much of this precious material is saved and utilized as possible. That is where you come in. Remember, too, that there are no absolute tests that you can depend upon for beef condemnation and that the experience of a qualified butcher is often of much greater value in selecting the good part than the judgment of the doctor. Let me ask then that in the future when you meet such a situation you follow the procedure outlined below:

(a) First have the carcass unwrapped and then washed thoroughly with salt and water.

(b) Next, with the assistance of the best butcher you can find in the outfit, go over the exposed surfaces and carefully trim off all parts that are tainted. If the covered parts seem to be affected, have the covering tissue removed by the butcher, taking care not to cut into the flesh. Do not condemn any part of the carcass until these preliminary steps have been taken.

(c) You are now ready to examine the joints to see whether decay has started there. Do this by probe at the shoulder and hip joint. The smell on the probe will tell the story, and it is not necessary to slash the quarter. If you find taint have the butcher dissect out the bone and then trim away the meat adjacent until you reach a good layer. Remember always that the problem is to save as much good meat as possible. This sort of procedure, if carefully done, will usually insure a saving of from 60 to 70 per cent of even badly slimed beef.

(d) To prevent flyblow, make sure that fly eggs are washed off the shank immediately after the beef arrives. They will be usually found on the shank and, if left, mean extensive decomposition and waste. In fact a safe procedure with all beef is to have the covers removed as soon as the beef comes in, have it washed with salt and water and then recovered with the cheesecloth. From that time on care will keep it sweet.

(e) The following methods are recommended for the conservation of frozen beef: Hang in an airy, well-ventilated place out of the direct rays of the sun. Meat safes covered with cheesecloth or screening to exclude the flies, but allowing a free access of air, will protect the beef for several days if it is wiped as often as it becomes covered with moisture. Dry mold is harmless; slime is the thing to prevent. If it is necessary to retain cut beef for more than 24 hours, it may be placed in a container and covered with salt-water brine, but in cutting up beef see that the outer skin is removed if tainted before the knife cuts the flesh. A piece of tainted skin carried into the meat will taint the whole batch.

Nobody wishes tainted meat used for food, but that does not necessitate wholesale condemnation.

Your work in beef conservation, however, does not stop here. It is equally important to see that every part of the carcass is used to its maximum nutritional efficiency. The stock pot is an instrument of conservation and also provides material for both soups and gravies. There is no excuse for green bones in the garbage can.

4. I have used the above as one example of how you as medical officers are most important conservation agents. Let me develop other phases of this particular function of yours. Beef in the form of stum, day after day, means both dissatisfaction and waste. Man likes variety in his diet. If he doesn't get it he soon loses appetite and the garbage can gets the food that should nourish him. That idea calls attention to the need for continual inspection of menus. Line officers know little of balanced diets. They depend upon your criticism to cover that point in the feeding of the men. Furthermore, it is a very easy matter to include in your mess inspections a glance from time to time at the posted menu. That of course means that there must be such a thing as a posted menu, and you should insist on finding it. Failure to find one usually means that the cooks and mess sergeants are giving very little attention to variety. You can't vary the garrison ration without giving that attention, and the menu is the key to the situation. Please make that a part of your inspection and, as prophylaxis against nutritional disturbances and lowered morale, it will repay the effort.

5. A second big feature of our ration is bread. The American Army is now the only collection of individuals in the world who are allowed to eat white bread. Your wife and mine can't get it. Every one in the United States of America is straining to save wheat for our use. They are paying 10 cents a pound for Victory bread in New York City to-day. Before the war wheat averaged about \$1 a bushel. It is now worth \$2.18. Since the war began our exports to England have increased 170 per cent, to France 364 per cent, to Italy 330 per cent. We are literally supplying the world with wheat, and at great sacrifice to our families. That should at least make it imperative for us to exercise the greatest care in conserving the supply. There are two sides of this problem where you can be effective.

First. In the utilization by the mess. Watch the garbage can and the bread box. If bread appears in the former it is a matter for drastic action. See that slices are cut thinner or halved and that men take only what they can eat. See that scraps are utilized as bread pudding, as bases for desserts, as croutons for soup. There are many ways of getting full value of the bread ration and no excuse for its wastage.

Second. There has recently been considerable trouble with bread mold. Its cause is even yet uncertain, but we hope the solution is in sight. You can, however, help in the matter. On the bottom of each loaf shipped will be found a paper pasted, giving the date the bread was baked and the number of the company that baked it. These data are significant. Don't take hearsay on mold hereafter. Require the loaf produced. Note the date. Learn from your railhead officer how long it should take to get bread to the outfit. If the date on the loaf indicates it has been abnormally long in the unit, locate the trouble there. Find out the conditions under which it is stored in the mess. In brief, first make sure that the trouble is not in the organization. If sure on all these points, notify us, giving date and bakery company number. We have then got something to work on and do not need to make a long trip to learn facts readily available to you. General complaints mean nothing; facts we can act upon.

6. I have referred before to the value of the garbage pail as a means of diagnosis of mess inefficiency. Another source of information is the mess storeroom. And right here let me interpolate a word as to mess inspection generally. I have seen too many messes that have been O. K'd by the sanitary inspector that were models of cleanliness and absolutely ineffi-

cient as purveyors of food to hungry men. When you inspect a rifle your aim is to see that it is in condition to shoot, to function. The functioning of a kitchen is what we are most concerned about, and unless your inspection insures that, the other features are relatively unimportant. I realize that you are not mess officers, but you are directly concerned with the health and nutrition of the men and responsible for it. That I think justifies the following suggestions.

I have already illustrated in the case of the meat and the bread the way in which the garbage can serves as an indicator of waste. Let me consider a typical case in which the storeroom serves the same purpose. One often finds in the storehouses an accumulation of sugar. You will usually find such messes complaining of lack of sufficient bread. The reason is not immediately obvious. The sugar allowance is ample to provide for the making of desserts, and the garrison ration provides materials for over 30 of such desserts if the cooks will take the trouble to study their Cook's Manuals and work them up. If these desserts are not made, the men crave sweets and the nearest substitute is bread. Try to eat a heavy meat and vegetable meal without a dessert to top it and you will find yourself reaching for the bread to offset the cloying effect of the excess in the other direction. Given a dessert, this need is satisfied. This example is only one of many. An accumulation of any ration article in the storehouse has a meaning that translated into nutritional needs is indicative of some defect in mess management. A little study will reveal these and help greatly in making your kitchen more effective.

Take another example of another sort. Accumulation of lard in the mess-room storerooms under the present ration issue should indicate a defect of the ration and in fact is really complimentary to the cook. The reason lies in the fact that the meat ration supplies so great an amount of fat that if this is properly rendered it is sufficient for practically all cooking needs. In that case the lard component is too large. Now that fact is actually established and steps have been taken to reduce the lard allowance 50 per cent and increase milk and fruit 100 per cent. These changes will go into effect soon. But unless the matter is carefully checked your units will run out of cooking fat, as soon as this change goes into effect. The fat must be saved to permit the change, and by reducing the space taken by the lard we are enabled to increase the bulk of other foods desired without increased shipping space.

This whole question of fat saving in fact assumes very important proportions. The salvage department has arranged to receive all excess fat and to pay the units for it. There are hosts of messes in the American Expeditionary Forces where the installation of a simple grease trap would not only help to keep the dishwater from polluting the ground but will yield an appreciable amount of fat for salvage. A little interest in this feature will go far to realize an appreciable saving of this substance for glycerine and ammunition. We are the only army that has not taken active measures to secure the conservation of this by-product. In England the cooks' salaries are determined in part by their efforts in this fat-saving effort. In our Army we have seen the excess lard used to kindle a green-wood fire. Such things are criminal.

Without enlarging on this point further, I think you will grant that it is worth while for the medical officer to make a careful study of these two diagnostic agencies, the storeroom and the garbage pail, and to develop their significance as indices of mess conditions.

7. Another field that I wish to call your attention to is that of necessity for study of the ration as issued. It is a deplorable fact that very few mess sergeants and cooks have an accurate knowledge of what the ration is. The next time you make your sanitary round ask each mess sergeant how much beef his men are entitled to each day. You will, I think, be greatly surprised to learn how few are informed on this essential subject. The reason is not far to seek. Until the troops reached France the ration was simply a system of accounting. The ration-savings principle had made the sergeant and cook more or less adept at using the ration allowance to obtain variety and build a mess fund. Arrived here, the savings principle stopped; the ration was issued in kind; the sergeant and cook got the idea that their job was to take what was given them by the supply officer and do the best they could with it. They took no trouble to learn what they had a right to demand. As a result there is an appalling ignorance of what the ration as issued entitles them to. There

are very serious consequences arising from this state of affairs, and you can help to remedy it. Will you not see to it that every mess sergeant in your future commands not only knows what ration he is entitled to but also exactly how it is issued. Unless he does his judgment as to the special requirements of his men are absolutely unreliable. I recently investigated a demand for increased ration on the part of a labor troop where the statement was made that more food of a certain sort was needed and that the meat ration could be cut 40 per cent. Investigation showed that the meat ration had through ignorance been overdrawn that month some 40 per cent. Such a condition made it absolutely impossible to tell whether the ration was adequate or not.

8. There is nothing sacred about the ration. It can be changed as needed. It has already been changed in France, and a new set of changes will be issued soon. But at present it supplies nearly 4,200 calories. It is capable of very great variety of menu making to the careful student of its components. You will be asked frequently to pass on requests for changes to meet the needs of particular troops. Please consider these requests food for careful digestion and not for snap judgment. Study the organization. Before recommendation satisfy yourself on the following points:

- (a) Is the organization getting its full ration allowance?
- (b) Is the ration getting into the men and not into the garbage can?
- (c) Is the dissatisfaction due to actual hunger or to failure in menu making and cooking?

If these conditions are satisfactorily complied with, you have a case and quick action can be taken thereon.

9. I have dwelt to-day on a few of the phases of food conservation in the Army that affect the medical officer. They are intended to be suggestive rather than exhaustive of the subject. Venereal inspection and clean dishes are only a small part of the duty of the sanitary inspector who covers mess conditions, and an active interest on his part in the conditions that make for good messing will go far to relieve the troubles occasioned by green cooks, inefficient mess sergeants, and uninformed line officers. The care of the sick is important, but in that care you are looking after the liabilities of an army. There is no way in which you can do more effective work in winning battles than in caring for the assets of the Army, its fighting forces. At the same time you will be actually seeing to it that the food so carefully saved at home by the sacrifices of our families goes where it was intended to go—to win the war.

10. Followed a brief outline of the duties of the food and nutrition section of the chief surgeon's office and the method in which it might serve to assist the medical officer in his work.

(NOTE.—Evaporated potatoes should be soaked till they swell up to nearly their normal size. The time necessary varies with the kind of potato and the character of the water. Tin vessels should not be used for soaking, as they are apt to turn the potatoes dark. They are best served as a mashed or creamed potato.)

(NOTE.—The general orders referring to rations are as follows: General Orders, 1917, 18, 38, 67, 78; General Orders, 1918, 19, 44, 54, 70.)

Army Sanitary School No. 136.

THE EFFORT SYNDROME, TOGETHER WITH A CONSIDERATION OF THE SIGNIFICANCE OF CERTAIN MURMURS

Delivered to the class of the fourth session, Army Sanitary School, April 29, 1918, by
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The war has altered opinion of the value of many signs formerly accepted as important indications of the presence of organic heart disease. The chief sign involved in the changed point of view is the systolic murmur. The significance attached to diastolic murmurs, both the diastolic murmur of aortic insufficiency and the presystolic murmur (auriculo-systolic) of mitral stenosis, has remained unaltered. Individuals afflicted with these two diseases have been found not to bear the strain of war satisfactorily, even if at the time of enlistment they were free of any indication of heart failure. They are now accordingly rejected for service.

The significance of systolic murmurs, especially their relation to mitral insufficiency, however, has occasioned much discussion. Systolic murmurs occur in so large a number of individuals that it has become necessary to decide when they are important and denote mitral insufficiency. The need for making the distinction between important and unimportant systolic murmurs occurred infrequently in civil life; young men rarely sought medical advice on account of such murmurs. When they did, as the result of life insurance or other accidental examination, the difficulty in diagnosis was appreciated, but reliable guides for making a decision were wanting. Early in the war men with such murmurs were accepted and many were found after severe service to bear the fatigue incident to campaigning satisfactorily. The conclusion was therefore drawn that the murmur in itself must in these instances be considered unimportant. New criteria were accordingly required to decide which systolic murmurs were and which were not important.

Until now it has been customary to divide murmurs into two groups—functional and organic. To decide in which group a murmur belonged, it was studied from the point of view of the bearing on it of the posture of the body, of the position in the precordial area at which the murmur was best heard, of its character on auscultation, according to its intensity in different respiratory phases, according to the direction of its transmission, and according to its time incidence in the cardiac cycle.

A word should first be said on the use of the words "functional" and "organic" in relation to murmurs. A murmur is of course a physical phenomenon and dependent on the structure of the containing vessels and the arrangement of the surrounding tissues for its production and character. This is true of the so-called functional murmur as well as of the organic variety. All murmurs are in this sense organic. The distinction which the words "functional" and "organic" were intended to convey relates to their importance or unimportance, or perhaps better to their significance or insignificance. The point is in itself not important except in the interest of clear understanding.

Close study has failed to show that systolic murmurs can be classified as significant or insignificant according to the criteria just enumerated—that is to say, posture, position, character, respiratory emphasis, transmission, and position in the cardiac cycle. It is of course true that aid may be obtained from certain of these criteria, but the aid is not definitive. Other criteria have therefore been proposed. These relate (1) to the size of the heart, (2) to the history of infection, especially of rheumatism, (3) to the intensity of the second sound in the second left interspace or third left costo-chondral junction, and (4) to the reaction to exertion. A candidate may be accepted for service in the Army if his heart is normal in size, if there has been no history of rheumatism, if the second cardiac sound is not accentuated, and if the response to a standard exercise test is normal, even though a systolic murmur is present. The terms used require explanation.

The heart is normal in size in adult males in civil life in the third decade, when in the oblique position it measures from 9 to 11 cm. In active military service the size often increases to 11 to 13 cm., and these dimensions are considered normal. The measurements given are based on X-ray plates placed when exposed 2 m. from the target of the X-ray tube. Attention must be called in this connection to the fact that all normal hearts do not lie in this oblique position in the chest. Frequently their outline shows them to have a more vertical position in the mid-thoracic region; sometimes they have a more nearly transverse position. These variations naturally make the diagnosis of hypertrophy difficult and must be taken into consideration in deciding on its presence. An hypertrophied vertical heart may in profile be smaller than a normal transverse organ. In every instance, therefore a correct estimate of size may not be possible.

The second criterion mentioned is the history of infection, and especially rheumatism. Under rheumatism are included acute rheumatic fever, chorea, tertiocolis, tonsillitis, growing pains. It is obvious that a single attack of acute rheumatic fever occurring in childhood, and having been followed by no obvious cardiac disability, is not important as are repeated attacks, the last having occurred within the year.

The third criterion relates to the intensity of the second sound. It is not possible to state that the second sound is invariably accentuated when chronic mitral endocarditis has persisted for a prolonged period, but it is believed to be the rule that after long-standing

disease an accentuation takes place. Its presence is therefore of significance in deciding that disqualifying disease has occurred.

The nature of the response to a standard exercise test is the fourth criterion. The introduction of the test is important, for it gives information of what one desires to know as the result of examination; that is to say, the ability to undergo exertion. The test recommended in Circular 21, Surgeon General's Office, consists in hopping 100 times on the left foot so that the shoulder is elevated from 4 to 6 inches. Two minutes after the end of this exercise the ventricular rate should return to within 10 beats of normal and the blood pressure to normal. The test is recommended because it is simple and can be carried out in a uniform manner.

It is not pretended that one can rely on these criteria always to solve a difficulty in diagnosis when a systolic murmur is present. But they are useful when, in addition to the murmur, the heart is barely enlarged and a history of repeated and recent attacks of rheumatic fever is reported.

A word should be said about the character of the apex impulse. It has been the habit to lay stress on its extent and position and on the force or other slight abnormalities presented by it on palpitation. Recently abundant experience has tended to confirm one in the impression that too much stress is laid on these phenomena. But as an indication of the position of the left border of the area of cardiac dullness, in estimating hypertrophy the location of the apex, especially its furthest extension to the left, is valuable.

These views in respect to the systolic murmur represent the chief alteration which has been made in the point of view of organic heart disease. Of far greater importance is a symptom complex, functional in nature and, although not confined to soldiers, especially common in war. It is a group of symptoms, referred by soldiers to the cardio-vascular system, and forming a frequent cause of more or less serious disability. This group of symptoms was first described as a clinical entity during the Civil War in the United States by Harthorne, and the description was later elaborated in greater detail by DaCosta. By the latter it was called the "irritable heart of soldiers"; and the disorder was known by this name until the present war.

The reason for its occurrence was sought in our own and other armies. Its cause was laid first to one and then to another circumstance. It was found everywhere and under all conditions. During the present war attention was forcibly directed to the affection because of the large numbers of soldiers whom it involved. With the new work on the subject, the name of Thomas Lewis is closely connected. His recommendation that the affection be known by the term "effort syndrome" has fortunately been accepted in the American Expeditionary Forces. It is classed in the British service as disordered action of the heart (D. A. H.).

The affection is characterized principally by the occurrence of breathlessness, giddiness, a sense of fatigue, pain in the chest, often in the region of the precordium, and palpitation. On examination are found, in addition, an anxious facies, tremor or shakiness of the fingers alone or of the extremities or even of the whole trunk, cyanosis, sweating, skin hypersensitiveness, both hyperesthesia or hypesthesia (head zones), tachycardia; and on questioning one learns besides of headache and of unpleasant dreams at night. Many of the symptoms suggest the presence of the heart failure of chronic valvular disease. It will be seen, however, that this affection is strikingly different. It need scarcely be pointed out that both conditions may coexist.

Naturally all these symptoms are not necessarily present in the same patients, and besides the individual symptoms vary in the degree of severity. Indeed the clinical picture varies within wide limits. In consequence experience is required in order to recognize the cases, especially in the milder forms. Patients may, in fact, complain of a single symptom only. The most frequent of them, according to Hume, is pain in the chest occurring in 768 of 1,000 cases. Breathlessness comes next (675), then giddiness (403), palpitation (354), precordial tenderness (268), fainting with loss of consciousness (98), and fainting without loss of consciousness (25). As a matter of fact it happens frequently that only a single of these complaints causes the soldier to report at sick call. But in addition to his complaint

suppose it to be precordial pain, he is likely to look worried, his face drawn, his brow contracted, his eyes unduly anxious, his hands and fingers ashake. Questioning may elicit the fact that he suffers from headache, bad dreams at night, pain of a fugitive nature elsewhere in the body, and an increasing disability to do work. Examination discloses the presence of certain physical signs, to be discussed later. While the clinical picture which has just been drawn is common, the especial cause for sick report may be one of the other chief symptoms. Indeed any one of the chief complaints enumerated may appear alone and dominate the clinical picture. Experience must teach the large variety of combinations in which the chief symptoms occur. The peculiarities they present deserve detailed consideration.

The pain is usually located in the precordium or just above and to the left of it. Its position is not necessarily fixed; it may change from day to day. It may be felt on the right side of the chest, in the flanks or elsewhere. Sometimes, though, it is referred to the shoulders and arms. When the pain is in the chest, its character is usually sharp, sticking, and fleeting; rarely constricting. It is probably not experienced at night and it does not keep the patient awake. Effort tends to bring it on, just as it tends to bring on the other symptoms. Associated with pain, areas of skin hyperesthesia (head zones) are found in a quarter to one-half the cases. The intensity of this symptom varies. Patients may complain of it as due to the pressure of clothing; in other instances its presence is elicited on examination. Pressure between the fingers of the pectoral, deltoid, sternomastoid muscles may elicit unilateral or bilateral tenderness. Boas (personal communication) has in a similar manner found areas of hypesthesia. The frequency with which this occurs is not known.

Breathlessness is likewise a common complaint and often the sole one. It interferes altogether with the normal performance of duty, such as a route march. It may be impossible objectively to detect the symptom, but not infrequently the distress is obvious. The rate of the respiration may be much elevated, especially as the result of effort; frequencies of 60 to 80 per minute have been described. The relief from effort and the recumbent position usually are followed by the return of breathing to normal. But dyspnoea, even when the degree is so striking, does not require the patient to be propped up in the way that heart disease does. Patients sleep quite flat or on one pillow and the rate of breathing is normal. Cough and expectoration are not prominent.

There is, however, one type of case in which difficult breathing comes on, especially at night, in the form of attacks of nocturnal asthma. Such attacks are probably limited to those cases of the effort syndrome which have in addition been gassed. They are manifestations of gas poisoning rather than of the effort syndrome. They come on rather late (four to six weeks) after the gas attack. It is a form of respiratory distress which requires special mention under "Treatment."

In connection with breathlessness, are often combined the sensations of extreme fatigue or lassitude and giddiness. The sense of fatigue alone may be so great as to be incapacitating. Walking on a level for 100 yards may suffice to engage all the patient's effort. Carrying light equipment, using a shovel or rake may be quite beyond the individual's strength. Muscular tone may be low. The patient is then unable to resist the examiner's effort to extend the arm when he has previously been directed to hold it flexed. The muscular weakness may indeed be general.

Giddiness is a very common complaint. It is a type in which objects external to the patient apparently do not tend to circulate about him; it is expressed rather as a desire on his part to steady himself against the impulse to fall. Black spots and other abnormal visual phenomena, common in the vertigo of hypertensive circulatory diseases or in chronic nephritis, are not prominent complaints.

Attacks of fainting occur in a moderate number of men. Sometimes consciousness is retained; more often it is lost.

Cardiac palpitation is a common symptom. It may accompany elevation of the pulse rate, but it need not do so. It may persist during rest.

Examination of the patient brings out a number of signs in addition to those to which the patient has attracted attention. Prominent among these are tremor, sweating, and tachycardia. The tremor is coarse and is a shake rather than a tremor. It involves not only the fingers and hands, but occasionally all the extremities and the head and the entire trunk as well. Patients who have it in a marked degree, and have the anxious facies as well, present

a distressing picture. But the importance of the tremor, striking sign that it is, is easily exaggerated. Examples of it are widely distributed. It may occur in men who give no evidence of suffering from the effort syndrome. It is found in fact in great numbers of men who have never been away from a base port; on the other hand, it is entirely absent in equally large numbers of men who have served fairly long periods in the trenches and have sustained wounds. When it is associated with the effort syndrome, its prominence overshadows the picture, but in spite of that it has not, for the reasons given, been found valuable as a guide in diagnosis nor as an index of progress in treatment.

Profuse sweating is common, even when the weather forms no adequate reason for it. Sweat may stand on the face and drop from the axillæ. And there are other evidences of hyperactivity of the skin such as for instance, the occurrence of weals on stroking. The occurrence of head zones, both of hyperesthesia and hypesthesia, has already been mentioned.

Of special interest is the examination of the heart, to which most of the symptoms, as pain, breathlessness, tachycardia, fatigue, are naturally referred. The pulsation of the pre-cordium is often striking and may extend as a wavelike motion over two or three intercostal spaces. The thrust forward of the apex impulse may be especially forcible. It is often in fact felt to be so. A thrill is not felt, but very frequently the impulse is not the simple, single thrust normally experienced, but rather is split, giving the impression of a major thrust split into a succession of ill-defined minor parts. One is reminded of the thrill in presystole of mitral stenosis. But the thrill in mitral stenosis differs distinctly from this, especially in the matter of its timing; this one, due no doubt to overaction, occurs distinctly in systole, at the time of the first sound. A single sharp shock, synchronous with the second sound, is also often felt both at the apex and at the base. In size the heart is not enlarged; indeed measurement^a made from tele-Röntgenograms show that it tends to be smaller rather than larger than normal. An exact statement of size is, however, difficult to give. Normal size depends on the nature of the individual's activity. It is generally admitted that in the soldier on active field duty the average size is usually greater by 2 cm. than was his heart before enlistment. Estimations of size should take this fact into consideration. The expected total transverse measurement may be given as between 11 to 13 cm. It is doubtful whether in the effort syndrome cases, taking these facts into account, enlargement takes place. The precautions already urged in estimating the size of the heart apply, of course, equally here. On auscultation much difficulty has been experienced, in distinguishing what one hears from the signs of mitral stenosis. The first sound is often unclear; it has, as one might have expected on palpation, a serrated quality, the serrations being equal, confined within the limits of the first sound and replacing it. But it is precisely these serrations that cause confusion with the presystolic murmur of mitral stenosis. It need not be pointed out that serrations in the first sound are not the same as the crescendo murmur before that sound.^b When the rate of the heart is elevated, as is so often the case, the difficulty of accurate auscultation is naturally increased. Usually the second sound is not accentuated either at the apex nor in the base areas. The absence of accentuation is a sign of value, for although the following can not be said always to be true, it is nevertheless generally the fact that where mitral stenosis is actually present the second sound is accentuated. The liability to confusion is emphasized because the error in diagnosis has frequently been made and has wrought harm not only to the service but also to diagnostic standards. Occasionally the diagnosis of mitral stenosis is made because in recent years students and physicians have been urged not to fail to make this diagnosis even if the rumbling presystolic murmur is absent. They have been told that a snapping first sound suffices to establish the presence of the disease. The warning is proper, but insistence ought also to be laid on the fact that then an accentuated second sound should be looked for and be found present. It is not contended that the diagnosis of mitral stenosis can not or should not be made unless the characteristic murmur is present. The murmur is in fact not always present. But insistence should also be laid on the fact that then the diagnosis be made after due attention has been given to the history of the patient and to exact auscultation. Anxiety to avoid one error has led many into making the other.

^a Medical Research Committee, Special Report Series No. 8.

^b It is appreciated that insistence on the crescendo character is not quite proper, for, as Gerhardts has pointed out, the crescendo character of the murmur is not a property of its own, but is lent to it, because it terminates, when the P R time is normal, in a sharp first sound.

On occasion it is a difficult matter even after all precautions have been taken to be certain that a presystolic murmur is present. Various maneuvers have before now been recommended to make it evident; such as altering the posture of the patient holding the breath, undertaking exercises. Morison and Lewis (personal communication) have recently lit on another method, which they say is effective in certain instances. They lay the patient in the recumbent posture and place the bell of the stethoscope at the site where it is anticipated a presystolic murmur may be heard. The patient then inhales 3 minims of amyl nitrite. During the first 10 to 20 beats the only change heard is an acceleration in rate; during the second 10 to 20 beats, the anticipated murmur may appear; during the third 10 to 20 beats the murmur usually disappears. The duration of the test is short. Auscultation must be practiced continuously throughout its performance.

The effort syndrome is not associated with a disturbance in the rhythm of the heart. Regularity, except for sinus arrhythmia, which is a normal phenomenon is maintained. Although the affection does not involve a disordered action of the heart (D. A. H.), irregularities may naturally be found, as they are found accidentally in any large group in the community, but they are not a factor in the syndrome.

The rate of the heart beat is usually accelerated. The range (Table I) is between 90 and 110 in 46.2 per cent and between 110 and 130 in 26 per cent of the cases; or between 90 and 130 in 72.2 per cent of the cases. These figures are taken from Hume. There need be no elevation, as the table shows. It is perhaps important to point out that the rate tends to be unstable. In the same individual it may on the same or on successive days fluctuate between wide limits. Sometimes of course stability at one or another level may be maintained. The fact of instability is mentioned especially because of the tendency to use cardiac rate in estimating prognosis.

The significance of the affection we are considering has been the subject of a great deal of speculation. Certain suppositions in regard to its cause may be dismissed immediately; the importance of others must be weighed. And first may be dismissed the thought that there are racial predispositions toward its occurrence. During the war, cases have been found in all the armies, central as well as allied. And among the Allies it is found in Hindustani, Scotch, Irish, Welsh, Canadians, Australians, and New Zealanders. No race domiciled in the United States is free. It is found in nonsmoking peoples, like East Indians, as well as in smokers. It can not, however, be said that smoking is harmless, so far as aggravating the condition is concerned. Investigation has not shown that it is dependent on a specific infecting organism, nor is it always associated with the occurrence of trench fever or rheumatism. Many who have both diseases have not become subject to the effort syndrome. The liability, however, of men who have suffered from infectious diseases, and especially from trench fever, to suffer from the effort syndrome should not be overlooked. A point of especial importance relates to the tendency of trench fever to recur. Attacks are known to come on after afebrile intervals. The recurrences must be taken to indicate the possibility of residual infection. In view of the fact that on occasion tachycardia and its attendant symptoms are alone manifest, the infection itself may be regarded as involving the heart. It will be recalled that occurrences exactly similar are encountered in convalescence from typhoid fever, dysentery, influenza. The relation of the effort syndrome to acidosis is too vague to attach importance to the few uncertain experiments which have been reported. By the method of respiratory analysis Wilson and Levine (personal communication) failed to find that a deviation from the normal exists.

Of more importance is the possibility of the disturbance of thyroid secretion. Symptoms associated with Graves's disease are in some respects like these found in the effort syndrome. The symptoms in common are nervousness, tremor, and tachycardia. In the effort syndrome exophthalmos or thyroid enlargement are usually absent. There need be no diarrhoea. Tachycardia may be absent. The tremor is really no tremor, but a shake, and attains degrees of severity never seen in the most advanced cases of exophthalmic goiter. On the other hand, when tachycardia in Graves's disease develops to as high a rate as is attained in the effort syndrome, there is usually a certain degree of dyspnoea as well, and the size of the heart is definitely increased, whereas there is no reason for believing that this occurs in the effort syndrome. Between the conditions a striking difference is observed at night. When tachy-

cardia and dyspnoea in Graves's disease are sufficiently severe to attract attention, they persist as a rule. In the effort syndrome on the other hand, both disappear. The presence of small thyroid tumors or slight symmetrical enlargement of the gland can scarcely be taken as evidence in favor of hyperthyroidism. Such enlargements occur in large numbers of persons in certain sections of the United States as elsewhere. They are not necessarily accompanied by symptoms either of developing Graves's disease or of the effort syndrome.

The fact is appreciated that in the minor grades of both conditions, the symptoms may be vaguely defined and might easily be confused. Investigations should be instituted with the view of developing specific methods of diagnosis in the early stages. Such studies should yield important results for diagnosis and consequently for treatment. In the later stages when the cardinal symptoms of both are well established, no difficulty exists. For the present, reliance in diagnosis must be placed on the symptoms and signs already described.

A word should be said about those cases of the effort syndrome which occur after gassing. Confusion has occurred in relation to them. Many gassed cases have the symptoms of the effort syndrome; many, however, have not. But both groups develop the symptoms of nocturnal asthma to which reference has already been made. They have been found to have polycythæmia as well. Barcroft and Haldane and Meakins deserve credit for having called attention to this group of patients. Both symptoms, asthma and polycythæmia, are properly ascribed to a late stage of gassing. They may, of course, occur in individuals who have also the symptoms of the effort syndrome. But it must be clearly understood that such patients are sufferers from two complaints, late gassing and the effort syndrome. The two are not necessarily associated.

The most difficult part of the subject to discuss is its relation to the war psychoneuroses. In their pronounced forms, those naturally present no difficulty in diagnosis. Neither do the effort syndrome cases without psychoneurotic symptoms cause difficulty. But there are cases in large numbers which exhibit symptoms belonging to both groups. These cases present a twofold problem one in classification or diagnosis, the other in therapy. The difficulty in diagnosis lies at the very root of the problem. There is no disposition to add new elements of confusion to the subject, but another attitude toward the subject must be suggested. It is a fact that many effort syndrome cases have not arisen *de novo* as the result of the war. The taking of proper histories brings out the fact that the beginning of the affection is of long standing. The complaints were initially too insignificant and too little insistent to require serious attention. During military service, however, the civil factors of safety fail to suffice for the individual's protection, the defect becomes prominent, and the individual suffers. The important point is that the affection is of long standing but latent. It requires a stimulus, like the stress of war, to make the trouble latent. The stimulus becomes operative in a manner already habitual to the individual; this reaction is cardio-vascular.

Those classed as psychoneurotics have a similar history. The stimulus which drives their latent defects into consciousness is the same. They differ in that their previous histories and their personal psychology predispose them to a different reaction. The manifestations of their affection lie in the domain of neuropsychiatry and require no detailed description here.

There is another group of more complex nature, the individuals in which react to the stimuli of war by more and more varied manifestations, partly psychoneurotic, partly cardiovascular. In the same way reactions may be found which are for instance, gastrointestinal or muscular. In all these varieties the stimuli furnished by the war may be similar. The reaction is a matter partly of chance, partly of predisposition.

TREATMENT

Lewis has offered a most important contribution to the methods for managing the malady, especially from the military point of view. For this purpose there was required a technic for sorting men in grades for service. He concluded that the proper way of sorting men for physical exertion was to try out the men by physical tests. It was an obvious conclusion. Lewis succeeded in doing this by a system of graded exercises. The system works admirably, as is seen by the fact that in a certain group after 11 months of service, the classification then made proved to be substantially correct. But the limitations under

which work was done at the British Military Heart Hospital no doubt prevented the introduction of additions in treatment which a consideration of the affection indicates are obviously desirable.

The variety of origin of the cases must be remembered in arranging for their management. Some are convalescents from acute infections, especially trench fever, bronchitis, pneumonia. The management of convalescence after these infections must be designed to safeguard patients from damage dependent on the relighting of their infection. Relapse after trench fever is known to occur with moderate frequency and should promptly be recognized. When it occurs, it is thought to depend on an involvement of the heart muscle. In such circumstances, physical exertion is naturally not indicated. Other cases are of men who have been gassed. Others have been of long standing and existed before the war. Still others have obviously showed no predisposition to the affection before the war. In any case, the principles of treatment are the same. The general rules of hygiene must of course be observed. The men should be made to understand that they are not ill. They should, therefore, not be collected in hospitals. In hospitals, moreover, the constant contact with disease and the suggestions arising from this contact are undesirable but unavoidable. The proper environment for them is supplied by camps under suitable medico-military discipline. It is necessary to insist on the medical rather than the military side of the management, although there should be no underestimation of the importance of military discipline. The discipline must be rigid, but appropriate to the degree of disability of the men. Occupation must be found for them, and especially occupation for their minds. It is an error to permit them to rely on their own resources alone. When this side of their treatment is neglected, they speedily become bored, listless, and undisciplined; they begin to brood on their disability until their mental background, deranged in the first instance, is worse in the last state than in the first.

In practice, attention should be given to the minor sources of infection, such as infection of the accessory nasal sinuses, the teeth, tonsils, ears. These infections should be removed. Physical exercise should be arranged for them. Three methods are suggested; drill, farm or garden work, and games. The drill should be graded according to the ability of the individual to perform it. It can be varied both as to severity and as to duration. At best, however, drill can occupy only a small portion of the day and may be supplemented by route marches. Farm and garden work can, of course, also be adapted to the capacity for endurance of the individual for work of this kind. It has the advantage of variety and may be performed without that nervous strain which the sharp orders given at drill by the drill sergeant necessarily entails. The introduction of games invites men unconsciously to undertake a great deal of physical exercise without that feeling of compulsion which attaches to the other forms of exercise. Their number may be added to and varied by the imagination of the medical officers. To the forms of exercise may be added, if the facilities are presented, training in occupations of use in the Army. Advice as to these must be sought from time to time. Men are constantly wanted as stenographers, typists, telegraphers, mechanics in gun, automobile, or wagon repairing, railway attendants, and hospital orderlies.

The mention of disturbance in mental background leads naturally to a consideration of the share neuropsychiatrists must have in the treatment of certain of the cases. In point of fact, even when the symptoms are predominantly cardiovascular the neuropathic side of the picture is frequently prominently developed. The importance of this side of the therapeutic problem, if neglected, may actually increase during the period of treatment. The requirements for aid in this direction vary. The difficulties may be mimetic or inherent in the individuals. And again some men, reticent by nature, are troubled, in the attempt to suppress interest in their symptoms, by dreams of an uncomfortable kind.

It has been the purpose of this exposition to indicate the general features of this affection of soldiers. The attempt has been made to show how involved the symptom complex is, and how it touches intimately other domains in medicine aside from cardiovascular. Its etiology can not now be conscientiously indicated nor its exact relation to the numerous processes involved, which are familiar and the connection of which with this entity immediately suggest themselves. It is impossible to lay down rigid laws for treatment; they may be done only when the exact pathological physiology is established. But suggestions are

made for dealing with the problem not only for the purpose of sorting, which is purely military, but also for the purpose of therapeutic improvement, which is the aim of clinical medicine.

TABLE I

Pulse rates	Per cent	Pulse rates	Per cent
40 to 50.....	0.1	110 to 120.....	14.7
50 to 60.....	.5	120 to 130.....	11.3
60 to 70.....	1.8		
70 to 80.....	8.5		26.0
80 to 90.....	13.5	130 to 140.....	1.4
		140 to 150.....	.9
90 to 100.....	22.4	150 to 160.....	.1
100 to 110.....	23.8		
	46.2		

Army Sanitary School No. 138.

GENERAL ORGANIZATION OF THE MEDICAL CORPS OF THE FRENCH ARMY

By Major General Ruotte, Medical Corps

(Translation)

Gentlemen, the object of this lecture is to lay before you the organization of the French Army Medical Corps (*Service de Santé*), not as it was conceived at the beginning of hostilities or even before, when the regulations for the Medical Corps in the field were issued, but as it exists to-day, adapted to the newly created needs that the present war has brought forth. I shall try to make it as brief as possible, so as to give you a general view, a comprehensive outline, after which you should be able to fill in all questions of detail which we can not deal with now.

Regulations for the Field Medical Service had been framed upon notions which at that time were considered universally accepted truths, demonstrated by experience; yet observations made throughout nearly four years of warfare have shown that those same truths were just about so many errors, errors as undeniable to-day as these "truths" were undisputed heretofore.

Of these old axioms the principle were:

(1) A rapid war of movement, forcing a provision for light, mobile formations, which would not encumber the Army in its movements, and which from their character and manner of function would supply themselves largely from the locality in which they were cantoned by requisition.

(2) A number of casualties incomparably lower than that observed in almost all previous serious encounters.

(3) Asepsis or trivial infection of the wounds, the majority of which were from bullets, very rarely from shell and shrapnel, with only secondary infections to fear; hence it was sufficient to protect these wounds from the outside inward in order to prevent the serious danger seen in previous wars. As a consequence, surgical intervention was reduced to a minimum and consisted in early dressings and evacuation to the rear, the "packing up and sending" of the wounded, to quote a current expression of that day.

(4) Observance of conventions protecting the wounded and prohibiting the use of certain methods of warfare.

You have already refuted for yourselves those old axioms with the new facts furnished by this war. Nevertheless, let us consider these facts:

(1) War has been a stationary affair, immovable units were obliged to little by little increase their means of action in order to cope with all problems which demanded of them a solution.

(2) The number of casualties has attained a proportion heretofore unsuspected; wounds by large-caliber projectiles have been far more frequent than those caused by bullets. The dream of the humanitarian bullet has vanished at the sight of the dreadful infections com-

plicating such traumatisms, which to prevent has necessitated an earnest treatment immediately following the production of the wound. Hence the necessity for reducing as much as possible the time elapsing between the traumatism and its surgical attention.

Finally, conventions have been more or less rejected and we have had to face in addition to bullets and shell splinters the vesicant and poisonous gases which have laid additional and unlooked for obligations upon us.

Therefore, the medical service has had to adapt itself to meet the problems presented by these new factors, utilizing to that end the experience furnished by daily observations—experience which was not to be had at the outbreak of hostilities.

If the general lines covering the handling of these problems have not changed radically from those laid down at the beginning, there have taken place important modifications in the whole plan, as I hope this lecture will show to you.

To set in order our study, we will divide our subject as follows: Personnel, organization for treatment, organization for transportation, for supplies, of sanitary units, and of vital statistics.

Distinction between service at the front and service in the rear.—The front comprises everything which assures an adequate service in the armies; the rear, everything which assures such service in the territory divided for this purpose into regions.

I. SERVICE IN THE REAR

The chief surgeons of the "Service de Santé" for each region, corresponding geographically to the territories occupied by the army corps in time of peace, provide for the administration of the service in each of these regions, both from the standpoint of personnel as well as of hospital units; they provide for the admission and hospitalization of all sick and wounded which have been evacuated into the interior from the zone of the army, and they control the personnel in the rear liable to be sent to the front to replace the losses ceaselessly occurring.

II. SERVICE AT THE FRONT

Personnel.—At the outbreak of the war the personnel of the military Service de Santé was rated as follows:

Armies in the field:

1. Surgeon inspector general, head of the medical service of all the armies and personally charged with the general direction of the Service de Santé of the armies. Under him are the chief surgeons of each separate army.

The latter have under their immediate command (1) the chief surgeons of the army corps; (2) the chief surgeons of the lines of communication; (3) the chemical and bacteriological laboratory of the army.

Each corps chief surgeon commanded (1) the corps litter-bearer group (*groupe de brancardiers de corps*); (2) the division surgeons.

The division surgeons had under their orders (1) the surgeons of the combatant divisional organizations; (2) the commanding officers of the *groupe de brancardiers divisionnaires* (division litter-bearer group).

The chief surgeon of the *étapes* (lines of communication) had authority over the army units, ambulances, evacuation hospitals, and reserves of personnel, matériel, and medicines.

The organization into groups of armies has given rise to the following modifications in the military hierarchy:

At general headquarters we find, first, an inspector general of the medical corps, a true technical adviser to the *generalissimo*, but not exercising direct control over the medical services. His rôle is to make inspections and to keep the commander in chief informed of his services.

2. A surgeon inspector, who is no longer the chief of the medical services of the armies, but who, with the title of "médecin aide major général," serves as a liaison officer between general headquarters and the chief surgeons of the newly created groups of armies, to whom he transmits orders and instructions from the *generalissimo*. The chief surgeons of groups of armies have under their orders the chief surgeons of the various armies and the chief surgeon of the lines of communication, who has replaced the chief surgeon of the *étape* for each army.

Further down, classification of grades has not changed; the necessities of war have provided for consultants, or specialists, which we will later consider.

The regimental service is going to be described in another lecture; I am going to deal with that part of the organization which, starting with the sick and wounded already transported by the ambulance companies, takes them to sanitary units different from the first-aid stations and regimental infirmaries or cantonment infirmaries.

SANITARY UNITS OF THE ARMIES—AMBULANCES AND EVACUATION HOSPITALS

a. Ambulances.—The first sanitary unit is the ambulance.

At the outbreak of the war ambulances, though called division and army ambulances, were all identical and interchangeable, at least all those created by the 1910 Regulations, for all units existent previously were not as yet provided with this new matériel. The object of such an arrangement was to avoid the work and the loss of time which would result every time an ambulance had to free itself from its wounded before it could follow its division when the latter moved on. The ambulance remained on duty with the wounded until these were all evacuated, and it was substituted in the division by an army ambulance held for that purpose in reserve. Hence, ambulances were mobile units, with nothing but rather limited material capable of being transported in a few wagons. There was added to the ambulance as soon as it became immobilized a unit called a hospitalization section, carrying mainly beds and bedding. In spite of this provision and additional equipment, the ambulance had to rely largely on the requisitioning in the locality where it might happen to have to open up. The character of war developed trench warfare; the immobilization of units was a natural sequence. Ambulances have been so modified as to enhance their efficiency considerably; matériel of the Service de Santé has replaced matériel that used to be requisitioned. A number of these reinforced ambulances have been attached permanently to the divisions, which they follow everywhere, and the number of ambulances attached to divisions and army corps has been reduced.

The number of ambulances has been regulated as follows: To a division, 2 ambulances; to an army corps, 2 ambulances not forming part of the divisions; to an army, an indeterminate number, according to the importance and composition of the army, and subdivided into two categories: (1) Ambulances of the army, strictly interpreted, with their own transportation and teams; (2) *étape* ambulances, without teams, except for the supply truck. When it becomes necessary to move them they are loaded in truck requisitioned especially for the occasion.

The number of hospitalization sections provided to reinforce the matériel of the ambulances is: For a division, 1; for a corps, 2; for an army, an indefinite number.

Animal-drawn ambulances: The personnel consists of surgeons, 5; pharmacist, 1; administrative officer, 1; medical corps attendants, 38, including noncommissioned officers; drivers, 8.

Ambulances, not provided with transport: Surgeons, 5; pharmacist, 1; administrative officer, 1; medical corps attendants, 38, including noncommissioned officers; driver, 1.

Hospital sections: Medical corps attendants, 3, one of them a corporal; drivers, 2.

Animal-drawn ambulances have seven 2-horse wagons, while ambulances not provided with transport have only a supply wagon.

The necessities of war have given birth to a new organization—the surgical automobile ambulance, whose number varies in each army, and which is designed to reinforce an ordinary ambulance, to which it becomes attached where needed; such a unit, possessing a special surgical equipment and five automobiles, comprises the following personnel: Surgeons, 10; assistant surgeons, 10; corps men, 16; nurses, 8. It further includes 1 consulting surgeon and 4 surgical sections, whose composition we shall see later on.

b. Evacuation hospitals.—As a sequel to the ambulances we find the evacuation hospital.

During the first year of the war evacuation hospitals served only their original purpose—that of receiving sick and wounded. They equipped them, cared for them, and evacuated them on sanitary trains either to the interior or to centers for the *éclupes*; they were made up of two sections, each one equivalent to an ambulance; they lacked their own means of transportation and were therefore compelled to use the railroads. For this very reason they established themselves in depots or stations.

Aside from being a burden to railroad centers, the fact that they were to be situated in depots and stations where munitions and provisions and all manner of supplies were being handled, or troops entrained, exposed them to the attacks of the enemy; therefore they have moved out of the stations and main lines and have been established on spurs of the railroads at a respectable distance from these environments; these were often laid purposely to serve these units. On the other hand, not to delay the urgent attention required for sick and wounded and to avoid the useless sending of patients to the hospitals of the interior—men who were too slightly wounded—led to the establishment of a hospital service fused with the evacuation service, which provided for the medical and surgical care of patients. Finally the appearance of vesicant and poisonous gases determined the location of a service for the gassed in each of the larger evacuation hospitals, as will be seen when we study the organizations created to combat gas and its effects.

Evacuation hospitals are indeterminate in number, being employed according to the needs of an army, needs demonstrated not only by its strength but from its location in a given sector.

We have two types of evacuation hospitals, which will probably be fused into one:

Type A, of the beginning of the war, with its own personnel and divided into two sections, each being equivalent to an ambulance.

Type B, whose personnel is formed by a fixed basic element and an element of reinforcement composed of attached ambulances whose number is variable.

We see, then, that the ambulances and evacuation hospitals form the two great technical units of the front.

We have mentioned already the fact that complexity of duties gave rise to specialization; this specialization applies to the units and to the personnel.

SPECIALIZATION OF UNITS

We have already seen how the two division ambulances are specialized units, one being surgical for the intransportable; the other medical and distributive (triage).

The same applies to army corps; one of the two ambulances is reserved for surgery with the consulting surgeon of the army corps; the other receives indiscriminately the very slightly wounded and the sick.

In evacuation hospitals, necessity has led to a certain degree of specialization. Some (Gizancourt) receive only the sick, while others have surgical services annexed and are even exclusively surgical; i. e., Mont-Frenet; that of La Veuve is mixed. In principle, however, the H. O. E. should maintain its three subdivisions.

SURGICAL AND MEDICAL SPECIALTIES

Services for surgical specialties have been created at the front.

Ophthalmology and otology are parts of a special service in each army corps, installed in an ambulance, jointly with the consulting officer of the army corps; and an army service installed in an evacuation hospital with the chief of service of the army.

Dental prosthesis is organized with one service to an army, as well as genitourinary surgery, established in our case at the evacuation hospital of La Veuve.

For contagious and venereal diseases, these are isolated services, generally at evacuation hospitals or at special ambulances kept stationary for this purpose.

There is a service for psychiatry to each army, organized in the specific region.

Maxillo-facial surgery takes place in the zone of the line of communication.

For the serious fractures, the service includes generally two units, one at the front, the other in the region, both served by one and the same surgeon; the two make up a single organism to insure continuity of care in the treatment of these wounded.

SURGICAL TEAMS

For general surgery, surgeons have been organized in teams, with a permanent personnel. These teams possess a supplementary equipment and are liable to be moved in a body.

Each surgical team includes 1 surgeon, 1 assistant surgeon, 1 anesthetist, 2 dressers or nurses. The bringing together of several of these teams to form one unit, in time of great influx, favors steady work and thus insures a large output.

ORGANIZATION AGAINST GAS CASUALTIES—ORGANIZATION OF THE TREATMENT

The appearance of gas as a weapon of war has made it necessary to adopt special measures; some to protect combatants against gas attacks, others to treat men overtaken by them.

Gas is divided into two categories—vesicant gas and poisonous gas. All gassed are directed to special units. General disturbances caused by poisonous gas are treated by ordinary therapeutic methods. Cases of irritating and caustic gas (i. e., "yperite" gas) have compelled the adoption of special measures in view of the necessity for immediately withdrawing those exposed to the continued influence of such products. I shall not deal with the treatment, but will only mention the alkaline baths and the immediate change of impregnated clothing; I shall only speak of the organization for this treatment.

To that effect, several echelons have been created.

At the regimental dressing station.—Surgeons are supplied with soap and alkaline solutions and every man has a package of sodium bicarbonate; besides there are 24 outfits of clothing to replace gas-impregnated garments, as well as oxygen bags.

At the G. B. D. (division litter bearers).—One hundred outfits of clothing; alkaline solutions, and oxygen tanks in sufficient quantities.

At the G. A. D. (division ambulances).—One station for gassed men to a division, each including 3 Bessonneau tents for general service, 5 hospital tents for hospitalization, giving 120 beds and 400 outfits of clothing supplied by the corps litter bearers.

For an army.—One army station for gassed men in each evacuation hospital, with 3 Bessonneau tents for general service and 2 hospital hangars giving 240 beds.

One army convalescent center (centre de recuperation d'armée) to each army corps, capable of sheltering 1,500 gassed cases, the majority of them slight cases.

One line of communications convalescent center (centre de recuperation d'etapes) in the zone of the etapes (line of communications).

Such are the units of the advanced zone. In the rear there are hospitals for every specialty. The task of explaining them is not ours.

TRANSPORTATION AND EVACUATION

Let us study now how these sick and wounded are taken to these units and how they are discharged from them.

From the first-aid stations, to which they have been carried by regimental litter bearers, they are taken successively by division litter bearers or corps litter bearers, as the case may be, and by the sanitary automobile sections.

Division litter bearers (G. B. D.), attached, as the name indicates, to each division, are of two different types:

Type 1, or normal, comprises:

Surgeons.....	3	Chaplain.....	1
Assistant surgeons.....	2	Dentist.....	1
Pharmacists.....	1	Corps men.....	167
Assistant pharmacists.....	6	Trainmen.....	27
Administrative officer.....	1		

The transportation consists of horse-drawn ambulances and one sanitary automobile section, besides wheel litters.

Type 2 comprises:

Surgeons.....	3	Chaplain.....	1
Assistant surgeons.....	1	Dentist.....	1
Pharmacist.....	1	Corps men.....	124
Assistant pharmacist.....	1	Train men.....	23
Administrative officer.....	1		

Army corps litter-bearers (groupe de brancardiers de corps d'Armée) comprises:

Surgeons.....	2	Chaplains (divers denominations).....	4
Assistant surgeons.....	1	Dentist.....	1
Pharmacists.....	2	Corps men.....	164
Assistant pharmacists.....	2	Train men.....	10
Administrative officer.....	1		

There is no sanitary automobile section; instead, horse-drawn ambulances.

To this unit are attached the bathing section (section d'hygiène corporelle), and the laboratory of toxicology.

EVACUATION TAG

At the first-aid station the wounded man is given a diagnosis tag or hospital card; if this has not been done, it is provided for at the triage ambulance. This card is carried by the wounded man. When he leaves the evacuation hospital, he carries an envelope tied to his buttonhole containing the hospital card, evacuation order (No. 46), hospital records in his case, a radiographic tracing of his injury, if of bone; in short, all information useful to the surgeons who will eventually handle his case.

SANITARY AUTOMOBILE SECTIONS

These form an indefinite number of 20-car sanitary automobile sections, in proportion to the needs of the army.

As a general rule, while engagements of importance are going on, the army chief surgeon must have as many sanitary automobile sections as there are divisions engaged, in addition to the division sanitary automobile sections.

In this way, carried in ambulances, the wounded arrive finally at the evacuation hospitals which, as already mentioned, serve a threefold purpose: Evacuation; admission and sojourn of sick and wounded ("hospitalization"); treatment of gassed men.

From the evacuation hospitals, the men are evacuated on the hospitals in the rear (camp and general hospitals), or are sent back to their commands after a 10 days' leave, or else, as in the case of men suffering slightly from "yperite" gas ("yperités"), they are sent back directly without a leave.

All men evacuated as far as the so-called army units are entitled to this leave, while it is refused to men not going beyond army corps units. The barracks for "yperités" (men gassed with yperite gas) in the H. O. E. is considered an army corps unit, as well as the convalescent, gas centers ("centres d'écupération").

Trains take the sick and wounded to the interior; the regulating evacuation hospital ("hôpital d'évacuation régulatrice"), which no longer depends upon the army, but the D. E. ("direction d'étapes") directs these trains to their destination.

They arrive in the interior at the distributing stations and are there given orders for their ultimate destination.

There are three kinds of trains: Permanent trains; semipermanent trains, with vestibuled cars; improvised trains, with cars for seated and recumbent wounded.

Trains leave from the regulating station at scheduled hours or upon the request of the army, according to necessity.

All along the evacuation lines there exist infirmaries and canteens which attend to the wounded soldiers en passage and help carry out and take care of such wounded men as are deemed unable to proceed further with their journey.

SPECIAL SANITARY UNITS

In addition to these basic units of the medical department, we have special units: Army laboratories of bacteriology and chemistry, supervised by the chief surgeon of the army.

Sanitary sections, two per army corps, in charge of sanitation and disinfection of cantonments.

Personal hygiene sections (sections d'hygiène corporelle), variable in number, whose mission is to operate shower baths for the men and to disinfect their clothing.

Corps organizations and other units in charge of the "disinsectization" of men and clothes.

SUPPLY

The supply of sanitary units is carried out through several agencies:

(1) *In the zone of the interior.*—Supply depots which receive from the central storehouse of the medical department and the central drug storehouse all the matériel needed for the armies.

(2) *In each army.*—A sanitary reserve of matériel and a reserve of medicine is established at the regulating depot ("gare régulatrice").

Corps and division units sent in requests to the army chief surgeon and these are verified, approved, and sent to the sanitary reserve of the regulating depot, from which place supplies are shipped on the daily train to the supplying stations, whence they are secured by the corps and division units.

Secondary depots to provide for emergency calls are established in a variable number by the chief surgeon of the army at different points of the sector covered by that army.

Vital statistics are collected by sectors. A specially trained statistical officer gathers all information concerning the dead and their probable heirs and sends it to the returns bureau in Paris.

Army Sanitary School No. 139.

VISIT TO THE HOSPITAL ST. NICOLAS, KNOWN AS THE AMBRINE HOSPITAL, AT ISSY MOULINEUX

First Session, Army Sanitary School, December 7, 1917

This hospital is devoted to the treatment of burns, trench foot, and deformities resulting from cicatrices of the skin, chiefly of the face. The hospital is an old-fashioned one of the time of the Baudeloque hospital, but is comfortable and clean. Ambrine is a proprietary preparation which is furnished this hospital gratis by the manufacturers for the treatment of all of the burns of war. It is supposed to be a mixture of paraffin with certain resinous drugs, and comes in one-half pound cakes of a dull amber color. This is melted in a special room containing water baths, from which room it is conveyed in liquid form to all parts of the hospital for application to burns. Its boiling point is about 230° C., and great care is taken that the temperature shall never rise above this to avoid fire. In fact the heating of this ambrine requires elaborate precaution against fire in this old, wooden floored hospital. Ambrine is an anhydrous substance, capable of conserving heat a long time without burning the skin. It is not only useful for burns but also for indolent ulcers and trench foot; it is excellent for the stimulation of all granulations, and especially for their epidermatization. Ambrine is resterilized and used over and over again. It can be heated, but not above 120° or 125° C.

In its application for burns, the usual technic is to carefully cleanse the burned area and surrounding skin, under the strictest aseptic technic, with sterile water, using rubber gloves, and sponging with sterile gauze sponges, applied by means of dressing forceps. Great emphasis is laid on the fact that at the first and subsequent dressings great care should be exercised to avoid damaging the burned flesh mechanically by rough sponging. The surface should never bleed, nor should soap be used. After this preparation the wound is dried by hot air and dry gauze and hot ambrine is applied at from 50° C. to 60° C. with a soft brush or atomizer. Having applied the first coating of ambrine, a thin layer of sterile gauze or cotton is laid upon the wound and more ambrine is painted over this. The pain is instantly alleviated, and large dressings are applied over all and held by bandages.

Redressings are done as follows:

If pus is present when the old dressing is removed, the burn is carefully washed with boiled water, to which a little peroxide of hydrogen has been added. The wound must be well dried before applying ambrine. Do this by a thin layer of gauze. This drying is accomplished best by an electric hot-air dryer held about 3 feet from the wound. Ether may be used. To test if the surface is dry, apply lightly a thin layer of gauze; this should come away easily without sticking at all if the desired degree of dryness has been attained.

It is well before reapplying the ambrine to spread zinc oxide ointment on the edges of the newly formed skin. The reason why it is so important to dry the wound is that ambrine added to water will burn. When granulations get too high apply a wet dressing of normal salt solution and peroxide of hydrogen for 24 hours. For the treatment of X-ray burns, steam for 20 minutes, by means of a special apparatus, with about half a pint of normal salt solution, applied as a spray with the steam. Now the burn was absolutely dried and ambrine was applied.

When the patient comes in freshly burned and suffering a great deal, no attempt is made to wash the wound, but it is painted at once, and at the first redressing the dirt comes away with the dressing. There is almost always pus under an ambrine dressing, but it does not seem to affect the healing. Blisters are punctured, but the skin is not cut away. These dressings are changed daily at first and later every two days. The dressing is easily removed en masse and the devitalized tissue is promptly sloughed off, leaving clean, red, healthy granulations and islets of new epidermis.

It was interesting to know that ambrine was invented by Dr. Barthe de Sandfort, and it was recommended many years ago as a remedy for burns, but not apparently sufficiently investigated by the general profession.

In burns of the first degree, for economic reasons, the parts, where possible, are immersed in a bath of paraffin for many hours at a time. Care should be taken to have all dressings very loosely applied. All cases of burns and trench foot are given antitetanic serum.

Application of this paraffin bath method for the treatment of trench foot is very interesting. They always use paraffin foot baths for trench foot, even for extreme cases with gangrene. The effect is to hasten the sloughing off of irretrievably lost tissue and to stimulate healthy granulations along the line of demarcation. Such cases are apt to take two to three months in healing. We saw some of these cases and they were proceeding rapidly to a cure. The foot bath is 6 by 16 inches and 6 inches deep. The paraffin is heated slowly by hot-water coils to 60° to 80°. The foot is left 20 minutes in the bath, then it is covered by cotton which is soaked in paraffin, making a shoe or sabot, which the patient wears until next day. When the shoe of paraffin was then removed the feet were massaged with camphor liniment and dressed by absorbent cotton. It is preferred to use this foot bath for three-quarters of an hour every day until a decided improvement, when the interval can be prolonged to every two days.

In general the treatment of burns by ambrine is very remarkable in its results. It was perfectly evident to all of us who saw the large number of cases that if the burns could be got at immediately the results were little short of marvellous, as the cicatrices, especially of the face, and the deforming contractures of the skin in other parts of the body, can be reduced to a minimum. In many of the burns of the face, which looked from photographs taken at the time to have presaged permanent and horrible scars, only the closest observation of the patients seen thereafter could detect that they had been burned. Any one who goes through this hospital will be perfectly convinced of the efficacy of covering these burns with paraffin mixture (whether you call it ambrine or not), and excluding the air.

As to their treatment of trench foot, where it can be applied in a hospital, it seems to be a most excellent method; but this can never be anything but a treatment de luxe, as this condition must be treated at the front, and ambrine can not there be thus applied, ordinarily. It was said that trench foot with gangrene could be more favorably treated with ambrine than by paraffin.

We were also shown that ambrine can be used to combat the remote effects of mustard gas burns. One man there had been burned 20 days before by mustard gas, was quite healed, and stated that the pain was instantly taken away by the use of ambrine. In this case we saw a remarkable pigmentation of the skin for all portions of the body which had been burned. Doctor Pfulbe, in charge of the work of this hospital, stated that he never uses soap to clean up burns of large areas, but in the H. O. E. at Bouleuse the burn is always first cleaned by a neutral soap solution consisting of: 2 kilos of castile soap cut up into small pieces, 10 liters of hot water. Leave to dissolve slowly by contact, filter through gauze, and add cold glycerin, 1 kilo; alcohol (90 per cent) 250 c. c. Neutralize with boric acid.

The faith of the nurses, patients, and, indeed, the physicians in ambrine was almost childlike in its loyalty. The attitude was that burns and trench foot might be bettered rapidly by paraffin, but that if ambrine were used the success was assured in the shortest time. Indeed, one of the statements made was that ordinary gunshot wounds in a state of suppuration, after all the operative procedure necessary had been accomplished, and when it was simply necessary to allow the wound to heal by granulation, healed just as rapidly under ambrine as if Carrel's method had been employed.

One of the most interesting remarks was that made concerning trench foot as we were coming out, after going through the wards, to the effect that in all cases of trench foot it can be noticed that the patient's vitality is at a low ebb; that all of these patients are sad and depressed.

We were not given an opportunity to see the subcutaneous injection of oxygen by an apparatus which not only regulates the rate of delivery but the pressure of the gas. The apparatus costs Fr. 450 for a doctor. The machine is made by Jules Richards, 25 rue Melingie, Paris. If the pressure on the dial upon the apparatus is nil it is a sign that the oxygen is entering the vein, and the needle must be instantly withdrawn and inserted elsewhere. The object is to liberate the oxygen into the subcutaneous tissue and make it effective for whatever purpose it may be used. For instance, it is believed that the subcutaneous injection of oxygen acts as a general tonic as well as a local one to tissues, and not only stimulates granulation but general health. In other words, they utilize it when "the respiratory function of the skin is reduced by burns over large areas." He states it is also a benefit in furnishing oxygen in gassed cases and in the healing of wounds. The instrument is electrically controlled and was really a very pretty one. The oxygen is passed through it from an ordinary tank. Ten cubic centimeters per minute through a needle is the usual rate of delivery. Of course, we were not prepared to accept as logical any such use of oxygen.

The last thing of note seen in this place was a matter in which there may be some value for further study, namely, the injection of beechwood creosote, removed of its irritating properties, in oil (1:15), for the purpose of reducing cicatricial tissue. The chief part of its application is the preparation of the creosote. The method was the injection by an ordinary dental syringe of this creosote and oil, at a distance from or directly into the scar tissue. We saw the results in some 50 ambulatory cases treated by this method, and they certainly were remarkable if the photographs of their previous condition are to be admitted in evidence. The scars were soft and there was a general loosening up of subcutaneous tissue. Absolutely pure beechwood creosote and olive oil were employed. The injection is performed by the dental syringe above noted or by long, fine needles, under one atmosphere of pressure, every other day. In the latter case, they work up from 1 or 2 cubic centimeters to 30 cubic centimeters at a time. Of course, the old faith in creosote injected subcutaneously for the treatment of tuberculosis was immediately revived by this method, and a large clinic for civilians was held at this hospital for the injection of creosote purified by their method for the treatment of tuberculosis. Their faith in it was complete. In injecting the creosote and oil, the operator injects only one-half cubic centimeter at a time when the injection is first made directly under the scar, but Doctor Pfulbe seemed to believe firmly in the injection of 30 cubic centimeter doses anywhere in the body, stating that scars anywhere would be dissolved by that method.

The dispensary where this treatment was going on was conducted by Doctor Le Sieur and Doctor Brisson. Doctor Le Sieur guardedly advanced the theory that overproduction of connective tissue in a scar, as in a burn (always termed a keloid by the workers in this hospital), was apt to be in persons in whom the tuberculin test was positive. Thus the effect of creosote was subtly explained in causing this excess tissue to disappear as the peculiar antiseptic effect of creosote on the tubercle bacillus was accepted as a dictum. In short "pseudo-keloid" tissue, causing excessive and deforming scars, is to be interpreted as a manifestation of serofula or skin tuberculosis, and for this the purified, nonirritating creosote in neutral oil seemed to act as a specific.

For the preparation of this creosote there is a special chemist and a special laboratory. The chemist is an excellent one, and he demonstrated to us his technique. The creosote is distilled at from 200° to 215° C. and thus the irritating phenols and the caustic substances are eliminated. This distilled creosote contains 25 per cent of guaiacol, and this percentage it should have for injection.

The olive oil of commerce is acid and its exact acidity is determined by titration against a decinormal sodium hydrate solution with phenolphthalein as an indicator. It is neutralized by sodium hydrate and to this alcohol is added. It is heated to 100° or 110° C. (because a higher heat would decompose the soaps formed by the addition of sodium hydrate into the

fatty acids and glycerin and nullify all previous work). It is now allowed to sediment and the pure neutral oil is decanted off and filtered. After this washing with alcohol it is ready for use. All bottles are sterilized before they are turned out for distribution.

(NOTE.—The alcohol is added to precipitate the soaps, and after this it is filtered and the alcohol distilled off at the temperature above noted.)

Army Sanitary School No. 140.

LECTURE TO THE MEDICAL OFFICERS, DELEGATES FROM THE NATIONAL MUNITION FACTORIES, TO FOLLOW A COURSE, IN ACCORDANCE WITH INSTRUCTIONS OF THE SECRETARY OF WAR, IN THE "AMBRINE" SERVICE OF THE ANNEX V. R. 61 (ST. NICOLAS), OF THE VER-SAILLES MILITARY HOSPITAL

By Dr. Barthe de Sandfort

(Translated by Maj. Alfred J. Ostheimer, M. R. C.)

Gentlemen, great honor has been done me by your being sent here to become familiar with a form of treatment which may seem paradoxical from certain standpoints, but which, however, is nothing but physiotherapy. Ambrine is a physical and not a chemical nor pharmaceutical agent; it acts only on account of its heat-retaining and contractile qualities. Before you enter my service, I would like you to leave behind all preconceived ideas as to the necessity of draining all wounds. You have already seen, and you will see, islands of skin form and grow, especially in those places where lymph, so copiously secreted under my shell-like dressings, is found in abundance. I have already shown you a burn of the arm where the healing process is going on much more rapidly on the posterior or more dependent surface which is bathed in lymph.

In the trench-foot cases you have seen the granulation tissue climbing over the heads of the metatarsal bones, in which necrosis had begun, and you have seen healthy tissue form about these doubtful bones. Don't stop to argue about the doctrine, but just look at the results obtained. When I discovered, over 16 years ago, the advantage of paraffin, used either alone or in association with resinous gum (ambrine), I believe that I opened up a new and most fertile field in which the work of others will far exceed my modest efforts soon to be forgotten. All that I have to say has no object other than to demonstrate to you a simple method, and one that is sure to allow nature to integrally reconstruct the tissues, solely by affording heat, protection, and isolation under my wax-shelllike dressings.

Ambrine is a mixture of paraffin and resinous gums which occurs in the form of amber-colored plates, of a slightly resinous odor; solid, and in density close to that of the paraffins. This substance liquefies at about 50° C. and its boiling point is 230° C.; this must not be exceeded because the gases then emitted are inflammable and may give rise to accidents. In order not to change its properties, we recommend slow heating by means of a low fire until a temperature of 125° to 130° C. is obtained; it is then unquestionably sterilized. It should then be kept in a water bath at a temperature of about 80° C. so that it may be used at any moment, just like a reserve supply of sterile water. Ambrine contracts on cooling. All that it is necessary to do in order to prove this contractility is to fix a graduated test tube into a small sack filled with water, and submerge the sack in liquid ambrine. It is then noted that the ambrine, on cooling, compresses the water and causes it to rise in the tube. It is easy to understand, therefore, that this physical property, which ambrine has, of contracting on cooling results in a compression of the adjacent organs and in itself constitutes a gentle and continuously compressing dressing.

Another physical property of the substance is its great caloric capacity and its ability to retain heat. Twenty-four hours after its application on the skin the temperature of ambrine is still in the neighborhood of 40° C. This can be proven in the following way: Coat the skin with a sufficiently thick layer of ambrine at 60° C. and include a thermometer, to be covered with cotton, saturated with ambrine, the whole arrangement to be hermetically sealed with wadding and bandages. If the air does not penetrate beneath the ambrine dressing, a temperature close to 39° or 40° will be registered the day after the application. What follows will better fix your ideas on this question of the prolonged conservation of heat. It

has been found that a mixture of cotton and 125 gm. of ambrine stays at about the temperature of solidification—that is, about 50° C.—for more than two hours, while a mixture of cotton and water cools off completely in 25 minutes. We have, therefore, made out of our ambrine dressing a sort of stove or incubator with a constant temperature. This is the explanation of most of the effects noted in the tissues thus protected, and placed in those conditions which are most favorable for cellular proliferation. You must have particularly noted the tolerance of the tissues for heat as applied by the ambrine method. But this point is so important that I will cite a control experiment that is a very simple one. Here are two containers, one of water, at 60° C., and the other with ambrine at the same temperature, which fact can be easily verified by the thermometer; if one puts his finger first in one and then in the other container it will be noted that the finger can not remain in the 60° C. water for more than a few seconds without feeling a scalding sensation, while, on the other hand, the finger can be left indefinitely in the ambrine. If the ambrine is brought up to 80° C. the finger can still be left in it for an appreciable length of time without burning, which is quite impossible in the case of water of the same temperature. At 120° C. immersion of the finger in ambrine is not painful and does not cause any burning; therefore, by the use of ambrine the unaltered skin can, without pain, be subjected to a heat higher than that which might be applied in any other way. The physiologic effects vary in accordance with the temperature at which the application is made. At 60° C. a dilation of the peripheral circulation is noted as well as hyperemia of the skin and a local functional increase in activity. In certain cases, when the coated surface is extensive, the application may produce a passing increase in the arterial pulse, a very slight rise of temperature accompanied by a general sensation of heat and, perhaps, even a slight perspiration.

I have often noticed another peculiarity without being able to determine its cause: Patients with very slight and hardly painful arthritic or traumatic manifestations (without actual wounds), have told me they felt a certain improvement in their symptoms after an application of ambrine. In 1905, in Professor Dantre's laboratory, I was able, together with Doctor Stodel, to control this interesting fact by animal experimentation. Several square centimeters of the skin on the internal surface of the thigh of 20 dogs were shaved, and I noted that for about an hour after the application of ambrine the most of these animals (exactly 17 out of 20) became so drowsy that it was not possible to attract their attention, either by calling them or by offering food. You see, therefore, that ambrine, although it does not contain any medication, still has a general sedative as well as a local analgesic action. Quite recently a man who had an X-ray burn, which I dressed with ambrine for the first time, told me that shortly after the application he became drowsy and in fact slept for three hours. I just mention these facts without trying to explain them, and I will now speak of the most prominent physiologic effect, which is the lessening of pain. I might show you this effect in other conditions, such as rheumatism, neuralgia, herpes zoster, etc., but I will to-day call your attention to those cases particularly connected with your course in this service; that is, burns and trench foot.

You can prove this, gentlemen, by questioning these patients one after the other; for they will all tell you that ever since the first dressing made after they arrived here they have ceased to suffer. You all know how difficult it is for the surgeon to treat burns with any amount of success, either early or late, and you have, no doubt, in the course of your careers had such patients drag on for months, and even years, waiting for cicatrization, which neither grafts, ointments, nor the various kerato-genetic products were able to bring about. When healing was brought about it usually was with some loss of function that necessitated surgical intervention, giving rise in the end to poor results from either an esthetic or a physiologic standpoint. You know how much these poor patients suffered at each change of dressings, so that it became necessary in the case of extensive burns to make use of general anesthesia. You also know how painful and how rebellious to all treatment X-ray or radium burns are. Since the use of ambrine this is no longer true. The dressing is applied and removed without pain, it does away with suffering, the scars are flexible and elastic, allowing the parts to retain movements, and being very rapidly formed, provided that the tissues have not been subjected to prolonged earlier treatment with antiseptic or strong reagents. The most brilliant results occur in those cases that are treated immediately after the accident. These burn cases come

to the dressing room without fear and without a murmur. I don't want to single out any one case particularly; I will, however, call your attention to two cases: One is a noncommissioned officer suffering from an X-ray burn of the left hypochondrium. This is several months old, and ambrine stopped all pain and has brought about a slow but regular healing of the wound. The other is a foreign patient suffering from splenomegaly, who, consequent upon many radium treatments, developed an extremely painful ulceration over the spleen. This wound dates from the month of August, 1916 (that is about six months ago), and after the first application of ambrine the patient was again able to sleep, his pain became considerably less, and healing is going on much faster than we had hoped for. You have been struck by the appearance, in the middle of these wounds, of epidermic islands, truly automatic grafts, resulting from the epithelial proliferation of the near-by skin. You have seen these islands become organized and unite with each other to form new skin in all its elements and as flexible as it was before. (All this repair goes on in a medium of lymph which could almost be taken for pus; it has a strong odor which should cause no surprise and should not under any circumstances interrupt the treatment. It is this point which will surprise you the most and it is one to which I attach the greatest importance.) Some of our dressing assistants are old burn cases whose faces are just as smooth as that of a child. The time of healing depends upon different factors; the nature of the cause of the burn, the depth of the lesion, and the general condition of the patient. It is possible to say, however, that the average duration of treatment for burns of the hand, feet, and of the face, of the second and third degrees, is 30 days, provided that the patient is in good condition, as I have frequently noted that if in the course of a treatment an intercurrent disease, such as angina, or enteritis, intervenes, the wound at once takes on a grayish appearance and healing is delayed, which proves that which I have always said. Ambrine is only a help to nature, an incubator at a regular and constant temperature so that it helps in the proliferation of these elements thus cultivated under cover if they are already vigorous, but if they are lacking in vitality on account of the morbid general condition, ambrine has no marked action. If the doing away with pain and the greater rapidity of cicatrization were the only advantages that ambrine has to offer, these would be quite enough to justify its employment. But there is still another advantage and that is the production of flexible, nonadherent scars; i. e., a reduction to the minimum of the formation of keloids. The histologists have finally begun to investigate the nature of the reparation of the tissues brought about by ambrine. We will take some extracts from the first investigation of Doctor Faure-Fremiet, chief of the histologic laboratory of the College of France, these preliminary notes being a part of the large work that he is about to prepare, after the investigations that he has been kind enough to carry out in this service.

The connective tissue seems to be like the embryonal mesoderm, the blood vessels increase and many of the (caryokinetic) figures of division appear in the cells of the walls of these vessels. The connective tissue framework is fine and delicate; there are no fibrous masses such as are found ordinarily in cicatricial tissue. The Malpighian layer is normal. It is seen to advance by cellular division and by extension, gradually covering the tissues. After ambrine is applied to a wound there is an active call for leucocytes. The serous fluid which is found is made up of an actual broth of polynuclear leucocytes with a few large mononuclears. On the other hand, on the superficial part of the unhealed area (the new reformed connective tissue) is seen a layer of polynuclear cells which seem to be degenerating and surrounded by an albuminoid material, which may be a sort of protecting covering. At all events this disappears when the Malpighian layer comes up to this level. From a bacteriologic standpoint there are few microbes after the second or third dressing, and those that are found are, in general, phagocyted (I have already shown you the photographs in colors of the negro, Medalou, whose second and third degree burns of his face and arm healed so perfectly that not a trace of the wound can be seen. The pigmentation was totally reproduced. There was, therefore, a complete restoration of the skin). Professor Letulle has also done some research work which quite confirms these conclusions in regard to the perfect healing brought about by ambrine. This rapid description suffices to show you the originality of this method, which may seem new in appearance, but which in reality is very much like the old procedures (diachylon cuirass, in Vigo, Guérin's dressing, the hot oil of Ambroise Paré, etc.). It only remains for me to point out some particulars in regard to the method of application which I should

like you to become familiar with by actual practice. It is absolutely necessary that you use the brush yourselves and do this frequently. Ambrine will be given you in the form of tablets; you will put the pounded ambrine in a container; you will melt it in a low fire so as not to destroy its properties. When you hear a slight sizzling of the liquid you will know that it has reached about 135°C ., and you will stop heating. The ambrine is then aseptic. It is not advisable to repeat this operation too often, as there is danger of lessening the efficacy of the ambrine, and after the first time it is well to melt the ambrine by means of a water bath. It is important to avoid having water come in contact with the ambrine, as unfortunate burns are brought about in this way. After having cleansed the wound, removed the blisters, and carefully dried the surface, cover it over with ambrine. To do this a soft brush is used, which is dipped into the sterile material and with which the burnt surface is rapidly sprinkled until it is completely covered. Do not bear down on the brush because you will cause pain and will bruise the delicate surface beneath which the repair is going on. Then a thin layer of cotton wadding is placed on this varnish and this is covered with another layer of ambrine so as to attach the cotton to the first layer. Then the ordinary covering of absorbent cotton and cotton wadding is bandaged on. This dressing is removed with the greatest ease. After the bandage has been cut and the cotton taken off, one comes down to the wax shell-like coat, which is incised and lifted up at the same time in order to avoid touching the wound with the instruments. The affected part comes out of this real mold without the slightest difficulty, and the wound is washed with boiled water; it is not advisable to use any strong antiseptic solution. If it is necessary to do a more complete cleansing, sterilized tampons of absorbent cotton dipped in boiled water are used, and with these it is advisable to limit oneself to a light sweeping off of the wound without rubbing or pressing. I advise you to avoid all friction and any marked stirring up of the tissues. The wound is then dried and the dressing begun as described above.

I won't go any further into this matter because you have seen and applied the procedure yourselves. You have also seen when and why we stop using ambrine in certain grayish-looking wounds and replace it by dressings, moist in a mixture of alcohol and water or in a weak solution of permanganate of potash or of oil of "gomenol." These are points in which clinical experience alone will guide you and upon which I will not dwell further. I will simply add that if healing is delayed it is best to dress with ambrine for two days, and on the third day to dress either with balsam of Peru or with "gomenol" oil. In some instances hot air may be used to advantage and even Dakin's solution. The treatment of chilblains is carried out in the same way. In order to diminish the pain of the neuritis consequent upon frostbites, I give 45-minute foot baths in paraffin melted about 60°C . A container in the form of a glass globe such as is used in an aquarium is filled with ambrine or paraffin; just now we are using paraffin, as it is less expensive than ambrine. Care should be taken that the patient's foot does not touch the bottom or sides of the container if it is a metal one. The paraffin solidifies and forms a shell-like covering which can easily be opened and removed whenever the bathed part is to be taken out. I have used ambrine with good results in old rebellious hyarthroses, in pleurodynias, in neuralgias, in gout cases, in inflammatory conditions of the testes, and in certain skin troubles. Besides in 1904 I published a certain number of observations made in the different services of the hospitals of Paris. In the case of boils and whitlows ambrine gives remarkable results; the course of the trouble is without pain; the core comes away with the dressing and no induration is left. We have a number of case reports of carbuncles in which the lessening of the pain, a rapid and easy elimination of the necrosed tissue, and complete repair of the loss of substance have always been brought about. This method is also the one of election in the case of varicose ulcers in which cicatrization is apt to take a rather long time and at all events much shorter with this than with any other way of dressing. The use of ambrine brings about cicatrization and a filling in of all loss of tissue. You saw in the ward an adjutant who had an enormous loss of substance from his left buttock. This man was sent to me after having spent some time in different hospitals, and in a short time the surface of the wound became considerably smaller. In 1914, I likewise treated a man whose shoulder had been disarticulated without leaving a flap to cover over the yawning surface so that repair was made most difficult. I used ambrine on the wound; cicatrization was very rapidly brought about under good circumstances, as you can see from these photographs. I

have also used this method in the treatment of nontuberculous fistulæ. To elucidate the mechanism of these repairs I would ask you to look at the drawing here. You will thus be able to follow the different phases which mark the repair of a wound under the influence of ambrine even when this wound is deep and uneven. The opening into the wound, whether fistulous or otherwise, is used as an entrance through which the liquid ambrine is injected by means of either an atomizer or a syringe until the waxy liquid pours out; then a small layer of cotton covered with ambrine is applied. It is well to put several layers, covering up a few centimeters around the entrance, as the general hyperemia resulting from this external shell will complete the local action of the injection. At the temperature of the body, ambrine, which was at about 90° C., becomes solid in the interior as well as on the surface, which at the same time brings about a contraction upon itself. The result is that after having become adherent to the sides of the wound for a certain time, thus exerting its germicidal and stimulating action, it is removed from the walls of the wound; it constitutes a small mold of the cavity in which it rests suspended by its connection with the outside shell formed by the skin. It is a waxy cork, a real flexible wick, or drain, absolutely sterile, which allows free escape to the outside of any liquid present or that may be formed inside the cavity. Under the influence of the temperature the walls of the cavity undergo marked changes, and in a very short time granulation begins, as we have observed in large wounds in horses where such observation was easier on account of the dimensions of all the parts concerned.

After 24 to 48 hours the first dressing is taken off; the cavity is diminished in size all all around by the thickness of the layers of granulation which now line it throughout and equally. This regularly progressive proliferation could not have been brought about by the use of a gauze wick or drain which is sure to impinge on certain spots and to miss others, as the will of the operator can not come into play in the execution of this blind procedure; and it is this point which makes our method so much better than all other methods used up to the present time for inducing granulation. Liquid ambrine penetrates everywhere equally, so then when it solidifies there is a uniform pressure and therefore equality in proliferation. In this way the production of connective tissue, advancing everywhere at the same time, fills up the wound without the formation of those irregular masses which become organized into annoying bands formed between granulations which may be some distance apart but which have grown up more rapidly, depending upon the position of the gauze drain. Upon the second application ambrine occupies only that space left by the first layer of granulations; it will be in contact with the granulating tissues for a certain length of time, thus acting as a germicide and inducing lymphocytosis. Its progressive contraction then leaves a new space open for a second growth of granulations, before which the ambrine retracts, maintaining, however, the uniformity of evolution without bruising the new tissues, checking it very slightly, as ambrine stays in a soft enough condition to give way to the pressure of the granulations. Sclerosis is going on at the same time, and it is only necessary to look at the drawings to easily follow the stages in the repair. The drain made of ambrine, at first liquid, then merely soft, grows proportionately smaller as the space left by the granulations and their organization into connective tissue becomes more and more restricted. When the fibrous tissue has arrived at the level of the entrance of the wound, the new epidermis is formed between the edges simply by their becoming united without any traction upon them, which explains the regularity and solidity of our scars. Another use of ambrine which I wish to speak of, which is not as well known as it should be, is the rapid cleansing of a wound in the advanced aid station by using ambrine. Those of you who have been working in the Army must have had wounds to dress which had to be rapidly cleansed and, if you will excuse the expression, the parts packed up so as to cause the least possible amount of attrition of the tissues, so as to immobilize the lesion, and so as to permit transportation of the patient with the least suffering. The cleansing of the wounds by this method is done mechanically. To test this, put in the palm of your hand a certain amount of dust or tobacco ash, then pour several centimeters of liquid ambrine over this; cover with a thin layer of cotton or paper, or any other substance which will become embedded in the wax; after complete cooling you will be able to remove at one time all the particles of dust, etc., which have become included in the cooled ambrine. Thanks to this material, you may also make a sort of rapidly constructed containing apparatus which, without having the

rigidity of plaster, will permit almost painless transportation of cases of open fractures even with fragmentation. It is likewise to be noted that the part done up in ambrine is kept heated, which is an important factor when transportation must be done in cold weather. Try the following experiment: Flex your fingers on the palm of the hand, submerge the hand in liquid ambrine for several seconds, then take the hand out and let it dry; on top of this thin shell place a thin layer of cotton and again dip the hand in liquid ambrine, and if you repeat this operation for four or five times you will note that after cooling the fingers are very firmly held in the position in which you placed them and that it requires a considerable effort to extend them. At the dressing station the surgeon need only split the shell and he will find a clean wound and the fragments in the position in which they were put up. I will close this short talk, gentlemen, in advising you not only to look at the photographs of the patients of this service, but also personally to make several dressings, so that when you return you will be able to make use of the ambrine method, which I am sure will be of service, and not only in cases of burns and frostbites, but also in the case of other injuries. A generalization of this method will be seen in the work which our colleague, Dr. M. Dubar, chief of ward 5, is doing at the present time. As a distinguished ophthalmologist, he is becoming able to make repairs in the case of ectropions which are so frequent in burns, by a very simple operation followed by ambrine dressings. These experiments were begun 10 years ago by the laminated Trousseau. In the same ward, Doctor Lesieur is successfully carrying out the leveling, bleaching, and making flexible of keloids, by injections of creosoted oil. Doctor Pfulbe, in charge of ward 4, will tell you of the good results that he and his colleague, Lesieur, have obtained in the rapid bringing back of the strength in those suffering from burns and trench foot by means of injections of oxygen. I trust you will take away with you, therefore, some interesting notes and ideas that may easily be applied in the organizations to which you belong.

Army Sanitary School No. 145.

LECTURE ON FIELD HOSPITALS

By Col. Bailey K. Ashford, M. C., United States Army

That there is some uncertainty concerning the use of field hospitals in modern warfare is putting it mildly. There is no medical department unit about which so much question has been raised. The first thing you hear on reaching France is that everything in this war is different from what you had been taught it would be. When you mention the field hospital in the midst of a crowd of medical officers who have been here a few months a perfect chorus of contradictory advice, opinion, and fixed ideas assails your ears. Hardly any two people agree on its proper use, no one agrees on what its equipment should be, and some believe it should be entirely abolished. A student officer came to me the other day and said: "I am completely at sea about my unit. We were carefully taught to bring our field hospital up to a certain definite standard for war service over here, and when I get here I hear that it is all wrong, that field hospitals are now being immobilized as venereal labor camps, delousing parlors, bathing establishments, gas hospitals, rest stations, dressing stations, and stations for the treatment of itch—anything but for mobile surgical advanced hospitals for which they were originally intended. What is the truth and where can I go to see something of this war? I don't want to run a medical department junk shop."

Some of our best men in civil surgery say we should be prohibited from doing any surgery in field hospitals, and it depends on the imagination of the speaker just how far he goes. Down at the base hospitals you hear men who have no experience whatsoever with conditions at the front wisely expatiating on the ignorance and unfitness of the men who insist on doing surgery in field hospitals that are not equipped for it. They usually wind up by strafing everything in front of them and by declaring that there ought to be a general order forbidding that any surgery be attempted in such places. "Send them back to us" they exclaim in a grim and saw-like voice, "and we will take care of them"—but there's the question, to send them back. Now, as a matter of fact, there is no real difference between the ability of the men at the front and the men at the big hospitals in the rear. The difference

is that each sees only the world in which he lives and supplies the rest from a mixture of prejudice and lurid imagination or from garbled stories of atrocities and incapacity of individuals he has picked up—chiefly from the soldier. The field hospital people hear about this or get expurgated editions of these fiery speeches, tempered out of politeness for their ears, and imagine the rest. The result is that when one and the other get together the barometer falls rapidly.

Now in a case of this kind, gentlemen, it is necessary that you get some facts before you draw your conclusions. The trouble with many of our people is that we draw our conclusions from our fertile imaginations when we ought to draw them from the facts.

I am going to try to put before you to-day some facts as we have seen them in a year and a half of observation of British, French, and American fronts from the North Sea to Alsace, in which we have talked with field hospital commanders and officers over and under them, as well as with all other medical officers from the humblest battalion surgeon to the chief surgeon of the army. Nor have we been limited to talking with them. We have lived amid these scenes and have seen these organizations functioning. I am going to ask you to remember what you learned about field hospitals out of a book and from training camp and their use in a war of movement. With all this, and then only, can we draw our conclusions.

In the first place war has changed, surgery has changed, everything has changed.

1. The field hospital was equipped and its tactical employment defined when 90 per cent of wounded were clean bullet wounds and troops changed their position every day. Up to very recently this war has been a war of siege in trenches, and 85 per cent of wounds have been due to high-explosive shells, or grenades, and all infected.

2. In addition to this, the range of fire has been greatly increased and especially of indirect fire, in which the reverse slope of a hill ceases to become a safe spot.

3. Visibility has been secured by means of airplanes and balloons and used against by the enemy.

4. The Cross of Geneva has been ruthlessly violated, and even well back out of gun range our hospitals have been attacked by enemy avions.

5. Military surgery, too, has changed. Once an aseptic dressing and rest sufficed to reclaim a large proportion of our wounded. Now all wounds are infected and must be operated upon as soon as possible—certainly within 12 hours if the ideal is to be approached, although operation in slightly wounded may be delayed 24 to 36 hours.

6. Radiology must be done at the front nowadays. No operation involving a lodged missile should be undertaken without it.

7. Antiseptics have given place to surgical sterilization—not by removing all bacteria but by removing the chief source, the clothing carried in by the missile, and by cutting away the dead tissue, the food for bacteria, without which they will be overcome by the living cells in which they fall. Such operations can not be complete under stress of great activity at the front, but they must be begun; and the wound well opened, and the missile and the clothing enveloping it removed.

8. Shock is far better understood because its predisposing causes are better understood. It is not merely hemorrhage, concussion, and pain that precipitate shock, but above all cold and exhaustion. Moreover the lack of rest and comfort plus the depressing influences that surround him have prepared the soldier for shock by reducing resistance—have removed his margin of safety against shock.

9. The fatal hemorrhages of other wars can be often averted by early surgical intervention and blood transfusion.

10. Only 2 to 4 of the 52 weeks of the year are ordinarily lived under combat conditions. The remainder of the time is spent in intrenched positions.

11. Rapid transportation to the first hospital capable of making men comfortable and providing modern surgical equipment for definition, operation, and hospitalization has taken the place of incomplete makeshift dressing stations and many stops on the way to the final destination of the wounded soldier. And the surgery of war has largely moved to the evacuation hospital just in the rear of the troops engaged.

12. In an attack we should prepare for at least 25 per cent of casualties, of which some will be unable to reach an evacuation hospital direct, which is the ideal, on account of distance, delay in transportation, etc., without seriously aggravating their condition or causing their death. It is for these latter that the field hospital is absolutely necessary, particularly in a war of movement by which the evacuation hospital is left farther and farther in the rear. With a near-by evacuation hospital over a good road, direct transport even of seriously wounded is preferred, but even then some must be held for operation or on account of shock at a field hospital.

The conclusions to be drawn from these facts are:

1. Field hospitals must operate farther to the rear than heretofore.
2. They must, at least in a war of movement, operate on some seriously wounded, notably chest and abdominal cases, as well as transfuse, deshoek, and in certain cases amputate.
3. Their equipment must be brought up to modern surgical requirements and their personnel must be reinforced by operating teams from the rear.
4. They must during inactivity be immobilized and made comfortable in hospital cantonments, provided with double-walled tents, good beds, and all of the dependencies necessary to supply good food, warmth, light, comfort, and amusement for the soldier.
5. They must be prepared at all times to advance or retreat with the command, carrying with them a definite part of their equipment, which can be made portable and which should be selected in advance, to permit them to carry on at another point under battle conditions. That is to say, they must be able to rapidly mobilize for movement, taking with them the combat essentials of a field hospital.

Let us see how these requirements are being actually met in this war.

First, in the British lines:

I have made a few brief notes from what is contained in that mass of literature prepared for you by this school, because I have seen it and may be able to tell you things not written there. In the first place General Thompson, chief surgeon of the first British Army, gave us a little sketch of the British field hospital. He said that the British field hospital, known as the field ambulance, is composed of two unequal divisions—a bearer division and a tent division, and that each one of these is divided into three equal parts, or sections. A section of the bearer division had 42 men and a section of a tent division had 23 men. Multiply these figures by 3 and you get the full personnel of the tent division and the bearer division. The total was 10 medical officers and 182 men, plus 49 Army Service Corps men—about 250 men—and you find that is what our field hospital plus ambulance company amounts to. He says in the old days they used to have a field hospital and ambulance company. They called them "field hospital" and "bearer company." This was in the South African War; but they found that they got to strafing each other—the commanding officers of the ambulance company and the field hospital had difficulties in working in harmony—there seems to be a general tendency to do that in all the armies—and as they didn't have time to carry on more than one war they put a lieutenant colonel over both of them and made a field ambulance out of it.

The object of the British field ambulance is to furnish a mobile operating hospital to accompany troops in the field wherever they go, and they are so equipped that they can go wherever a gun can go. That's the object of the British; the object of the French; the object of the American. There are 3 horsedrawn and 7 motor ambulances. They use the horse ambulances for the cantonment work. They use the motor ambulances to connect with the A. D. S. (advance dressing station); that is an outpost of the field ambulance and corresponds to our ambulance dressing station. The headquarters of the field ambulance is the M. D. S. (main dressing station.) The general said that the horse-drawn ambulances were useful when there was lots of mud, because they could put long ropes on the back of the ambulances and tired soldiers could hold on to them and help themselves along into camp on a long march in campaign; that they were very useful also for short hauls and to go where motors could not. He said the main dressing station—that is to say, our field hospital—was not a desirable institution at all where it was possible to get men back promptly to a C. C. S. (casualty clearing station) and, gentlemen, that is the spirit of the entire British

Army. What every man feels down in the bottom of his heart is that they don't want to send their wounded to the M. D. S., but prefer to get them direct to the C. C. S. That means that the British have never made of their field hospital everything they wanted to make of it, the thing we are failing to make of it, what we want to make of it. But when the A. D. S. is small and can't act as a good station, or the C. C. S. is very far to the rear, over a bad road or one liable to be blocked, then the main dressing station, or field hospital, becomes important, and why? Because it becomes an evacuation hospital. That's why, and that's what the French have done. They have made an evacuation hospital of it without calling it that. General Thompson emphasized the thought that all we call hospitals ought to be really hospitals in the modern sense of the war and not mere stopping places to delay a man getting in.

Now Colonel Jones, one of General Thompson's division surgeons, added a few things to that. He got to talking about the transportation, and said that in addition to these ambulances—the 3 horse-drawn and 7 motor—they have 6 general service wagons, just like our mule-drawn wagons, only they have heavy draft animals. They also have what we never had, 4 supply limbers; they even look just exactly like artillery caissons; in fact they are except that the caisson box takes dressings, etc. They have them in order to carry supplies from the main dressing station up to the advance dressing station; that is, from your field hospitals to your ambulance dressing stations. They also supply the R. A. P. (regimental aid posts), as they are called; they are not regimental posts, they are battalion posts—they supply these and are very well suited to that purpose. They are very light and quick and can go over any ground at all. He also told us that the transportation in the rear of the field hospital—from the field hospital to the casualty clearing station (our evacuation hospital) was carried on by the motor ambulance convoy. The motor ambulance convoy is a big company of motor vehicles—finest ambulances in the world; nothing like them that I have seen. There are 50 in a company and they distribute them for withdrawing wounded from the main dressing station to the casualty clearing station. They are an army unit and they are used as needed all over the army area. The French in their service call them S. S. A.—service sanitaire ambulance, I think is the real name for it. The point is that the transportation of the field ambulance doesn't transport any farther back than the M. D. S.; from there back to the casualty clearing station is by motor convoy. Now I asked another officer, an old field hospital commander, to tell me frankly what he thought ought to be changed in their field ambulance, and I was very much surprised to find that he considered it at least debatable that a field hospital is an anachronism. He believes a division should have augmented battalion personnel and augmented motor transportation companies, as well as a company of brigade stretcher bearers. He believes in taking away the tent division of the field ambulance completely; that is to say, taking away that portion of it used for hospitalization, our field hospital, leaving only the ambulance company part of the field ambulance; he believes in taking away the ambulance transportation entirely and would thus create a company of bearers; thus the ambulance service would run by means of the motor company all the way from the advance dressing station back. There are a great many things that would seem to indicate this is the proper thing to do in trench warfare, but in a war of movement I believe it would be a fatal mistake.

Let us review some of the field ambulances that we saw. I want to say that I have never seen, either in the British or the French Army, a mobile field hospital. They are all immobilized. The reason why we didn't see them mobilized was because then they were having a war of siege—trench warfare. Whenever armies come to a standstill and sit down in front of each other, these field ambulances ipso facto become immobilized. Now, it is well for us to remember always that it is force of circumstances and not any plan or army regulation that determines what should be done. Men respond to necessity along the lines of least resistance. This force of circumstances determines the plan.

I was anxious to see what the British were actually doing with their field ambulances. Their field ambulances were the only divisional medical service that they had. What happened was that about 8 km. from the front they would establish the headquarters of their field ambulance, their M. D. S. They would establish in buildings, and they generally have a very keen eye to getting a good place. The British medical officer is a very well accredited

man in his Army and it is, fortunately, an axiom in the British Army that one of the best places shall be given to the field ambulance. Consequently all the places selected for field hospitals were nice places, even pretty places.

Now here comes the spirit of the British. We have got to talk very plainly here to-day; there is no use trying to gloss over facts, and we are talking about facts. There are a number of men in our Army, I hope it is small, who think that the only things that are really necessary shall be supplied; that all things concerning the men's esthetic comfort be scrapped. I am not saying how many believe this, but with too many men it is true. They only think of "the practical things of life." A man must have so many calories. Here are canned beans, canned tomatoes, canned potatoes. There you are. Go out and sit on a manure pile and eat it; the food will do you just as much good there as at a table. You have three blankets; what more do you want? You have something to lie on—a bed sack of straw. That's the only way to make a soldier of you—give you the necessities and scrap all these fancy things. That idea is in the back of the head of the great many officers I have talked to, but it is not the spirit of the British Army. In the British Army the first consideration is the soldier's comfort. A hospital is a place where he will be made comfortable. They take into consideration not only his physical comfort but his esthetic comfort, and that's a strange thing to find in the apparently intensely practical Briton as we have seen him from our side. The British officer will do anything to make his soldiers comfortable in their mind and in their body—and in their soul, if he can. He provides them with chaplains and attaches these to the field ambulance or C. C. S.; he provides them with all kinds of amusements—games, all kinds of recreation. He is very methodical about it. He tries to keep people in good humor—goes to great lengths to do it. He insists on men being clean and takes the ground that good hygiene is nothing more or less than good habits; that no man can think well if he is dirty or slouchy; that his pride as a soldier decreases the moment he gets on a dirty uniform. And they are right; absolutely, unqualifiedly right. Therefore, you always find cobbler shops, tailor shops, etc., in all of these hospitals. Everybody shaves every day and everybody bathes just as often as they can and wears smart clothes. They generally get a château, perhaps along the side of a canal, in a wooded park, and they try to pick out what they call a restful place. I have seen some of them. In fact, one officer told me he always picked out a place for a field hospital where men would sort of forget the war, and then he went on to tell me that the night before they had been bombed and a lot of men killed in one of his wards. That's the spirit of the British Army; the comfort of the men is sought and they go to great lengths to get it.

But no people are more practical about things than the French. Some of their field hospitals are the best I have ever seen. I thought at first that perhaps they were a little behind the British, but each, in his own way, has made a mighty fine place for his men when they are wounded or sick. All the same, the racial characteristics have come out very strongly in sickness and injury. It is very remarkable to step from one to another, from British to French, and see the racial characteristics stand right out, in a hospital more clearly than in any place I know. Now we have to change in our Army very promptly before we really attain what we want to attain—the ideal. We are not making our men comfortable enough; nor is it in the mind of many of our medical officers that they should be comfortable in the sense the British provide comfort. We hustle them around too much at times; only too often we fail to think of whether they are cold or warm; whether their food is properly prepared and served or not. We have regulations covering these things, but do we always carry out the spirit of them? I am not speaking about you, of course; I am talking about what you will find too often. You will find men who will agree with what I am saying, but they won't practice it, and some who will say it isn't so from patriotic motives. Now, heretofore, the school has turned out men with these ideas of making the soldier happy and comfortable fixed in their minds. In those days we all used to go to the front and we saw these things. It requires no argument to convince a man who has once seen it. Anyone who has been through one British hospital will realize the full truth of that. And it is my unfortunate duty to-day to try to convince you without being able to show you. The conditions to-day won't permit our taking you up where this can be visualized, as we have no transportation, although we haven't given up hope of getting it by some means or other.

Now let's take an A. D. S. that I remember having seen in the first session of this school. It was in a château. There was a dressing and operating room—clean, warm, well painted, fully equipped with everything they needed for operation. You had to ask "Is this an evacuation hospital or a field hospital?"—you wouldn't know if you weren't told. It was immobile and was an up-to-date hospital and could meet modern surgical requirements. They had bucket latrines and incinerators. They always have a bucket latrine and always have an incinerator, and there is never any trouble about running them. I want to say, just incidentally, that the latrines are often near their kitchens, and they put them there on purpose. They say, "Keep your latrine clean and there is no danger at all." It makes them keep them clean. The incinerator serves to burn solid garbage as well as to burn feces. There is a man always on duty at that place. He is charged with the duty of keeping the incinerator going, and there is one by day and one by night. He is not put there as punishment, but is given extra pay for it. Now, near it is an ablution bench for soldiers to wash and shave. They get up in the morning, wash and shave, eat, and go to the latrines. That's much better than to go back in the woods. Personally I favor it very much. I never smelt a latrine the whole time I was in the British Army, nor feces anywhere, whether in hospital or anywhere else. It was sanitation under very difficult field conditions, and yet this was in the conscience of every private soldier; it was disgusting to him to be otherwise. Now the British were not always so. It is a gradual evolution of their national character from way back in London plague days. The people are really hygienic at heart. And this is the only real basis for practical hygiene—sanitation, where you convince the whole people.

There were two places in which the famous MacPherson latrine was in operation. It was a sort of adaptation of the Childs restaurant idea. They had taken biscuit tins and cut them down so that they would stand about 2 inches high, and fashioned them so there was a flange on the forward tin that ran over and hooked over the adjacent edge of another tin behind it. A little block was placed in the center under them where they came in contact, tilting the rear one backward and the front one forward. In the rear one was a square piece of newspaper. There were 8 or 10 of these imposing biscuit tin affairs on the cement floor. In front of these toilet facilities was a urine trough that led down to a soakage pit. The British soldier went in there; urinated first; went to the biscuit tin; straddled it, performed his duty; then solemnly got up and after cleansing himself picked up the four corners of the newspaper holding the feces he had evacuated and put them in the incinerator; then went back, took the forward tin which carried the surplus urine, and put that in the urine trough; and then went out. Perfect—perfect; no dirt; very neat and very nice. I asked the commanding officer how they would make a big outfit do that. He said "This is not for a big outfit." The real secret of it is this: The orderly on duty here is a fairly intelligent man. He is kept here all the time, and his orders are that if a man don't do the cleaning up himself he, the orderly, has to do it for him. The orderly selected is generally a husky man. He said if any commands come in that don't know very much about sanitation, this is a very good way to work it into their skulls.

Their kitchens were perfect. They were generally open on one side at least, and they were whitewashed inside, tarred outside. Their stoves were all blacked. They had stew stoves that we don't have—Soyer stoves, which they use a great deal for stews, etc. The point was that these places were absolutely clean, whitewashed or painted; that the cooks had white caps on, white aprons, and were always clean. You don't find somebody with a dirty old hat on the side of his head, and sleeves rolled up to his armpits, or going around with a cut-away effect of underclothing approximating the bathing suit—nothing of that sort at all. Everything was bright and clean, and they all took it very solemnly and seriously. Now, you found yourself looking in there and saying, "How do they get it so clean." The secret was they never had anything showing outside that they weren't using all the time. Now, one of the first things to learn, if you are an inspector, is that if you come to kitchens you will always find a mouthy cook or a cook's assistant that will say to you when you pick up some old piece of cracker box in a disorderly kitchen, "We need that to put something in"—always got a need for some unsightly trash around the place—brooms, brushes, combs, old shoes, etc. Now, people do have a use at times for that stuff—that's a fact; but the British don't allow those things to be out where you can see them. They have a room for such things, cupboards, or

some place where they can't be seen, as well as a clothing room for cooks and kitchen police. The place looks clean all the time; and such things have effect on the soldiers—on the appetite and the respect of a soldier for an orderly, neat-looking place. They say you ought always have a place to stow things away that are not being used every single minute, and those that are out are to be put where they came from when you are through with them. Such things are always spotlessly clean—knives sharp, well polished—everything of metal well polished, absolutely clean. They have food storehouses and their meat is separated from their bread and other things. Food conservation is down to the finest point in the British Army that I have ever seen it in my life—nothing like it. All these kitchens have grease traps: all grease, even grease from the floor, is recovered, rendered, and made into ammunition; every single bit of it, except the clean bits from the meat, which is used in place of lard and called drippings. These are small details of the workings of a field hospital.

They all have their canteen, their baths, their drying room for clothing, etc. The drying room was generally made this way: There was a Thresh disinfector in which they deloused their patient's clothing. This was always housed in and the smokestack, instead of going straight up, went across and then out through the drying room and that heated the room, and in that room they hung their clothing to dry. In connection with this they had their bath. The men went in and took off their outer clothing, passed it out to have it deloused in the Thresh disinfector, which is right there; took off their underclothing, threw it out of the window in a pile; went in, got their soap and towel, took their bath; then went into another room, got clean underclothing and got their sterilized deloused outer clothing; and then went on about their business. That was done with every single solitary man. They had a saddlery and a tailor shop. They have more artisans than we have. They run more to doing work by hand than we do. We have been running to machinery; we have been too much accustomed to having things made by machinery for us, so much so that we have forgotten the humbler trades—cobbler, blacksmith, etc. But in England they have hung onto them. They have an excellent animal corral and their transportation is simply perfect—perfect. When I tell you I saw a number—10 or 12—of their ambulances coming down a road, running a good pace with their quiet motors, slick, shiny, nicely painted, just as if they had just come out of shop, with all the metal gleaming, I said to the commanding officer, "I don't see how you get new machines." He said "Those ambulances are not new; they have been in service three years." I am not exaggerating; you couldn't have told them from new. And their harness. Their leather is pliable; it is perfect. There are absolutely no words that you could use that would be too high an encomium for the English harness. All the metal parts are highly polished; they gleam. It is a very imposing sight to see their transportation. Their wagons are always in a perfect state; they keep them in beautiful condition—much better than we do. No question about it. The care of the transportation, including the animals, is totally different from the care of the transportation of the French and Americans. After you see them yourselves you will be convinced. We attained that here at this school when we had the ambulance company here. It was easy to attain it—not by punishment but by appealing to the pride of the men. When an ambulance comes in, or harness comes in, with a lot of mud on it, their duty is to clean it right there. If the man is hungry, tired, or it is late, somebody else does it; but it is done. I have seen it in pouring rain for weeks at a time and it was done every time, every single time. That is the only way you keep your transportation in proper shape. Do you know that the French themselves have only scrapped about 50 automobiles a month for their entire Army? Now, will you please tell me how many we have scrapped for our entire Army so far?

Now, in the M. D. S. I am speaking about here, they kept their patients 48 hours before bringing them back to the C. C. S. They were wavering about how to employ their M. D. S. They had decided that all serious cases should be sent to the C. C. S. The Englishmen say if a man is seriously wounded his best chance is to get him to a C. C. S. quickly, but they sent some slightly wounded to the field hospitals, the sick, and also cases that were in bad shock or which ought to be stopped on the way back. They had three of these field ambulances per division. I saw a number of them—all very attractive, with plenty of shade, the grounds were kept well, good walks, well laid out, flower gardens provided. The men didn't lie around on the grass. All their men looked well: never slouchy, never; always had their coats buttoned

up, their buttons shined. They were an orderly, clean, God-fearing bunch, and it was a big thing to me because it was at the front, under shell fire, where men are killed from time to time. Now, don't say it can't be done in the midst of mud and ruins, because it is being done in the British Army right to-day.

Now, other things. Mind you, there is always at least one field ambulance used as an M. D. S. per division, which is not very large compared to our divisions; then in front of that they had their advance dressing station with a couple of officers and 20 to 30 men; and they rotated. Every 6 or 7 days they sent out another 2 officers and 20 to 30 men.

These field ambulances were also being used for other things. One of the things they use them for a great deal is a rest station. Now the rest station started out by being a field ambulance of the division, set aside for their slightly sick or gassed or exhausted; they sent the rest to the casualty clearing station. At the present time in the British Army they don't seem to use the field hospital for gas cases; they are sent to the casualty clearing station. This corps rest station will bear inspection, because we want to see what we can do to get something of our own from others, to imitate them or get better things. We saw one corps dressing station which was a field ambulance under the corps surgeon, but detached by roster from the division and kept there for a month or so, in sequence. They would take, say, field ambulance No. 151 for a month, No. 152 for the next month, and so on. That ambulance went in there with its entire combat equipment; but here is the point: The place for it was fixed and it had huts and was fitted up by the Red Cross, and fitted up well. They brought in the medical and surgical boxes and the personnel, but all the beds, etc., everything else, was provided by the Red Cross. They took in the slightly sick and exhausted, trench-foot cases, and cases of trench fever. They didn't do any surgery. They got their cases direct from the advance dressing station, main dressing station, or C. C. S., and this place acted very much as a sort of safety valve for the C. C. S. if it got crowded. The battalion surgeons do a great deal toward keeping up the efficiency of the men by sending them into a rest station before they get sick, men who need a rest, men who are tired out; and General Thompson said that sometimes men will sleep for 48 hours at a stretch. Its capacity is from 300 to 1,000. They give them rest, recreation, entertainments, theatricals, and plenty of open air. They return 80 per cent to their regiments in two weeks and avoided a great deal of sickness in that way. That's a good thing for us to imitate and the place for it is in our gas hospital. They were attractive places with reading and writing rooms, wicker chairs, carpets, etc. It was made as comfortable as it could be made. There was a good gymnasium, library, canteen, barber shop, and all of the usual dependencies. Every one of these places had all these things.

They would pick out a field ambulance here and there for a scabies hospital. That is important because scabies in the British Army is the cause of a great deal of inefficiency. The men get it, but they don't report it until they get impetigo or some other inflammatory skin condition, and then the average time a man is incapacitated is from four to six weeks. It is a tremendously important subject. They have got to get rid of scabies, and these scabies hospitals are very necessary. And how these field hospitals do hate it.

Let us take another main dressing station. Its capacity was 150. It was mainly in Nissen huts; no tents at all. It supplied the A. D. S. and R. A. P. stations. For the benefit of those who have just come in I will say that "A. D. S." corresponds to our ambulance dressing station, and it means in the English service advance dressing station. "R. A. P." is regimental aid post. They showed us the wonderful care of transport that I spoke of yesterday. Harness and wagons in excellent condition, looked like brand new. We also saw in this little hospital, meant to handle 150 patients, a barber shop, saddlery, canteen, baths, separate messes for officers, noncommissioned officers, and privates; incinerators, bucket latrines, beautiful kitchens; ward for medical cases and one for evacuation, and one for emergency surgery. The whole effect was that of a roadside inn. It was well white-washed, neat grounds, attractive château, etc.

At this hospital we saw what we saw at every field hospital and every evacuation hospital, that the kitchen had grease traps and that every bit of grease was saved. Ablution benches for the men, hot water for shaving near the latrine and near the incinerator, of course. The incinerator had a pipe connected with a tank which traversed the fire box, and which gave them hot water for shaving in the morning—to show what little detail the British make

use of to make their places comfortable. They had a lamp-cleaning house, harness shop, blacksmith shop, dugouts in cases of bombardment, which they had very frequently. They calculated that most men will be there only 48 hours, and notwithstanding that they had all of these comforts. I am harping on that to see if we can't create some public sentiment in our Army against this effete military plan of making men uncomfortable in order to look like soldiers. The discipline was perfect, as it was at all of these English hospitals. The only book they kept concerning the sick was the admission and discharge book, which is practically identical to the one we used to have in our service years ago.

Here is another hospital, English hospital, 4 miles from the line, field hospital, where they kept patients for some little while, an evacuation section, and a gas quarter. They had wards for slightly wounded, that digressed from the plan that slightly wounded shall go well to the rear. They had wards for the gassed. The operating preparations were perfect. Electric light and all of the little dependencies that I spoke of yesterday for the other hospitals—shoemakers, etc.

Now we come to the French Army.

We had seen a few of their field ambulances, and I am afraid we made a snapshot diagnosis that they were behind the British; we were still under the influence of the English at that time very strongly. The first one who talked about them was Professor Tuffier. Now Professor Tuffier is a very remarkable man, and all of us know him by reputation. He is a civil surgeon of a very fine type, speaks English very well, by the way; a man who is a very patriotic Frenchman; and at great personal loss—to his health—he has done much in this war; he has been throughout this war one of the chief—if not the chief—of the consulting heads in the department of the Service de Santé. Everyone has looked up to him a great deal. But he is no longer a young man in years; he has not been out under these field conditions for long periods, so he hasn't been through it from the viewpoint of the battalion surgeon. But he has done some wonderful work. He told us that all the field ambulances of the French Army used to be known as the *hopitaux de triage*. Triage has been the bete noir of the French Army. Now, gentlemen, I am going to say something here to-day that is going to be directly contrary to what you have heard some division surgeons advise from their experience in Chateau-Thierry. I don't think there is any question but that the early difficulties of the medical department of the French Army came largely from their early application of the triage. The French are great classifiers. They classify very well, but ideal classification takes time, and in striving for that ideal they lost the other ideal, which was to get the man back. Now war is a very disorderly sort of thing, and to try to carry it out by any fixed rules, to try to produce ideal conditions at any cost, makes ideally impossible conditions, ideally wrong conditions. The French field ambulance was established in the immediate rear of the fighting troops—3 or 4 km., too near to be a field hospital—established there as a triage or sorting place for all the wounded, sick, and gassed, sent there to be classified. They didn't do much of anything else but classify. From that place of course these men, being classified, were sent to the various points which were specialized for treatment of certain classes of cases. But what actually happened? If you want to see what actually happened go to the Val de Grace Museum in Paris and look at that exceedingly fine painting of a triage. It is a work of art, a beautiful thing; and there in the gathering darkness, just about as day was dying, with the wounded lying on stretchers out over the ground in every direction, in all stages of shock, without any protection at all, one or two tense doctors and nurses were going around with lanterns peering into the faces of the men to see what they had; some of the doctors taking off dressings to confirm diagnoses. They were kept under these conditions for hours at a time. What's the result? It's a block interposed in a main path to the rear without being able to remedy the condition. Perfectly unnecessary; absolutely unnecessary. It is improper to hold up all of these wounds in that manner. That's not the way to do triage. The French found that out and stopped it; but they went well into the war with it. Now instead of listening to them and modifying it as they have done, we are beginning it in the old wrong way. That kind of a triage means this: A man comes in wounded from the front. His battalion surgeon has dressed him and he would know more about him than anybody else, and he should put a diagnosis of what he has on the usual tag. That will do to get the man back to the hospital where he can be treated properly. I have

seen diagnoses such as this: "Compound fracture of the femur with probable injury to one of the principal vessels." That's enough. If that man stops anywhere on the way back they will look at it to see if he has been bleeding, but he ought to be sent direct by the battalion surgeon to where he can get proper treatment, and that's what the French do to-day. A formal triage which stops every man and makes him wait until he has been examined or only to have his tag read, without being able to apply a remedy, is courting disaster. Now this is the triage that we don't want to do in the American Army; it is the kind we are starting in to do, but it is a fatal mistake. You shouldn't do triage at any one place; you should do triage at all places, but only by reference to his diagnosis tag. Send the man in as fast as you can to get him to some place where he can have something done for him. Now there is a place where by far the most important triage is done, and that place is the advance surgical hospital for nontransportable cases and that is a field hospital; and Tuffier said "make that hospital a 200-bed hospital with 1 surgeon and four assistants." Certainly 3 or 4 km. is too close to the line; it should be 10. Now at these places of course you treat shock, hemorrhage, and all that sort of thing. You have to have a radiologist and a bacteriologist; no reason at all why you shouldn't.

Here are a few notes from General Ruotte. General Ruotte was chief surgeon of the French Army at Gallipoli. He says there are two ambulances to a division, two to a corps, and an indeterminate number to an army for reinforcement. The old French ambulance used to be an animal-drawn affair with 7 wagons; there were 5 surgeons, 1 pharmacist, 1 administrative officer, 8 drivers, and 38 enlisted men. That has been found not to be well enough equipped so they added to it the new surgical automobile ambulance, which is what they call the auto-chir. You hear of that a great deal, and it is known in our Army as the mobile hospital unit. They send it up and make of it a modern field hospital, with 10 surgeons, 10 assistant surgeons, 8 nurses, 16 enlisted men, and the consulting surgeon, with 4 surgical sections. They have a portable operating, radiologic, and sterilizing outfit, on 5 trucks. He said that one field ambulance was to be used for the nontransportable wounded and one for the sick and triage.

Some time ago we went up to the Sixth Army. This was a very interesting trip because our class had seen the Fourth Army and wanted to see the Sixth, and the Fourth and Sixth Armies were the ones the Germans broke through a few days after we got out. That was the break which took the boches down to Chateau-Thierry. Now Beaurieux was one of the prettiest villages I have seen. Very old, quite romantic, fine château, and all that sort of thing, and in the basement of that château was the field hospital, or rather the field hospital and the advanced surgical hospital. We had a talk with General Laznet, a young man, chief surgeon of the Sixth Army. Very active; like General Ruotte, always out in front somewhere—that's where we found him. He said his idea was to put one field ambulance per division as a triage as near as possible to the line and incorporate with it an advanced surgical team with equipment. He manned this advanced surgical hospital with the best surgeon he could get, a crew of female nurses, provided it with 15 to 50 beds, and saved at least some lives. General Laznet was getting down to what is about right. I never saw better outfits than they had. No private hospital in Paris had much of anything on them—spring beds, spotless linen, central heating, electric light and solid comfort. All of this 7 or 8 km. from the front.

We went to Veilly. That town was pretty well smashed up, but they had a beautiful hospital in the bowels of the earth—just like Beaurieux—and 7 km. from the line. From there some of us went to a famous stone quarry where they had one of these field ambulances and an advanced surgical group. This place was quoted as being the ideal advanced surgical hospital, right under the guns of the enemy. It was very near the line, in a quarry with 20 feet protection of solid rock. They had everything they needed; heat, light, and perfect equipment; and while they had only 15 beds, the place would hold an indefinite number of men.

We went back a little farther and saw another advance surgical hospital that was in a depression on a height 8 to 10 km. from the front. This hospital had a gas quarter and two Bessonneau tents. There was a good resuscitation ward. They kept all gas cases and the nontransportable.

Now, mind you, these were field hospitals, so-called; they preserved the name field ambulance, but in reality they were advance evacuation hospitals, and this was the first echelon of the new French scheme of having their evacuation in three lines. They run about 15 km. apart. That is the best way—no question about it, it is the best. In the second echelon is the field hospital of the corps, or the evacuation hospital.

We now reached this second echelon evacuation hospital, the H. O. E. (hôpital origine évacuation) du corps. This was a large unit holding a thousand. There were 4 Bessonneau hangers which held 250 gassed and 250 wounded. One hangar was filled with the non-evacuable, and there was here an eye and ear department. The rest were housed in small Bessonneaus. This was formed by a group of field ambulances of the corps.

We now reached the group of field hospitals for medical cases. This was one of six such groups for the sixth army and was the chief one. It was well in the rear, in the grounds and buildings of a fine château, near Soissons. In fact all their field hospitals for medical cases seemed well in the rear. The château buildings were surrounded by Service de Santé barracks. This group was the headquarters of the consulting physician of the army, the medical disability board, and the army laboratory. In addition, in an isolated section of the grounds, was a hospital for contagious diseases of some 250 beds. It was an army unit, although composed of field ambulances.

On one occasion we visited a group of three French field ambulances for seriously wounded on the Aisne and near the line. It was in a château reinforced by many barracks. The park was very attractive and no expense or trouble had been spared to make it thoroughly comfortable and ornate and to provide the soldier with every necessity. It was in command of the consulting surgeon of the army, M. Okinczyk, the exponent of advanced surgical hospitals. This one was shelled at times and on one occasion five surgeons had been killed there outright by one shell. The operating group, with its groupe complémentaire de chirurgie (our mobile surgical unit), was lodged in barracks, painted white interiorly, with plenty of electric light, ample central heating, city operating-room furniture, etc. There was an elaborate shock room with electric light canvas hoods for warming patients and windows therein through which the patient could be observed and through which an arm could be protruded for transfusion while the heating went on. The radiologic room was complete. They had an X-ray operating table and outfit, with a fluoroscopic operating bonnet, and a perfect sterilization plant. The hospitalization section was neatness, cleanliness, and comfort itself—linoleum on the floor, iron bunks well made up with sheets and blankets, walls painted (they were decorated the same way in all these hospitals), flowers on the table, nurses in attendance. One of the wards was kept for streptococcus cases, all of which were isolated. There was a good pathological and bacteriologic laboratory. There was here a triage and evacuation section. Only seriously wounded were held here as a rule, and it was a true field hospital—the first echelon surgical hospital of the French. By contrast with this excellent group in which the wounded were lodged in château and barrack buildings, we cite Chalons-sur-Vesle, in many respects the most complete and best administered field hospital group we have ever seen. The site was excellent, in a large château in a wooded park, on a good road and only 5 km. from the front. Here the patients were housed in tents; the operating equipment in a château and in a couple of barracks. This operating equipment was a groupe complémentaire de chirurgie on truck and tractor; and as the operating was done in the château, the portable operation pavillion was used exclusively for radiology. The electric lighting of the hospital was from this group and it yielded 150 32-candlepower lights. Here there were 3 operating rooms and 3 sterilizing rooms. These were all white enameled, centrally heated, and well equipped. Nine operating teams worked here, each composed of one surgeon, one assistant, and three enlisted men. There was a triage here at this hospital, and from the receiving rooms operative cases were sent to the preoperating room or to shock room as indicated. There was one medical officer detached to care for the shock and preoperating room, and he did nothing else.

The evacuation section was in Bessonneau tents and one Bessonneau hangar, and had a capacity of 1,000. It was really extraordinary the amount of equipment they had lavished on these wards and their cleanliness and cheeriness.

There was also a remarkable fine gas quarter here. It had its own triage, and chlorine cases were sent to the wards direct, the mustard gas cases to the bathing pavillion. This bathing and degassing outfit consisted of the following apartments in a partition barracks: Disrobing, bathing, alkaline solution to mucous membranes, fresh clothing, history taking, ward.

This field hospital group only took gassed and the severely wounded. Its capacity was from 500 to 1,500, as needed.

Division medical field ambulance.—This was run by M. Collin, a French medical officer who had been for a long time a regimental surgeon under Colonel Thoris, whose work you know, and he had shown us on a previous visit what we shall always remember as the finest regimental station we have seen to date. This hospital was also in a château, with a large wooded park on a hill which was filled with barrack wards. Its capacity was 300 and it received sick, skin diseases, and the gassed. It, too, was a model of neatness, lavish equipment, and furnishings and scientific work.

Divisional medical field ambulance.—There was a little field hospital, a divisional affair, that was devoted to the treatment of medical cases at Jouaigne. Beautifully situated; it was as pretty a country as I have seen. That hilly country invaded by the Germans is very, very beautiful; and this little hospital was in a château in a park, very comfortable, and devoted to medical cases. Its capacity was 400. It was installed in barracks and in the château itself. I was told there that they divided their cases into the slightly ill, not to be kept more than six days; the cases of incipient tuberculosis, and into other contagious diseases. I found out that this was the first place to which men suspected of tuberculosis came, and they had a radiologic outfit for medical diagnosis of these cases and heart cases. The tubercular never return to the front. The closed cases are sent to work in the rear, somewhere in the base sections, and the open cases are sent to sanatoria. They had a section devoted to the treatment of the ordinary diseases, and the chief diseases seen at that time were influenza and its dependent complications. At that time they were having an epidemic of three-day fever, and they had some very serious cases of pneumonia and pleurisy. Near this hospital was a rest station for officers in a large château, a perfect beauty, where they had all the comforts of home, and a mighty luxurious home, at that. We found both English and French here.

The division field ambulances near ———.—One was for slightly wounded and sick and the other for seriously wounded, with a *groupe complémentaire de chirurgie* attached. The latter was in a large seminary and was most excellent. The other was poor and in barracks. In addition a special army surgical hospital of 320 beds was provided for overflow and serious cases. It was of *Service de Santé* barracks and was also a good example of comfort and completeness. There was a section of this hospital devoted to the ambrine treatment of the burned.

Group of field ambulances for gassed and slightly wounded.—This was in a cantonment area; a rest area. It had a Bessonneau hangar for sitters, a barrack hospital, and a complete operating group with sterilizing, radiologic, and preoperating wards.

Field hospital in ———.—This was only 2 km. from the German trenches and was sheltered in old wine cellars under a municipal hospital. It accommodated 60 patients; but while excellent in equipment and neatness, it was too near the lines and in time of bombardment was cut off. Besides it was on a devious path to the rear. It was a triage and advanced surgical hospital, but the disadvantages of having a triage so near the lines and in an out-of-the-way corner of a ruined city were pointed out very clearly to us. Time was wasted in getting to it that might have been better employed by sending the wounded direct to the rear.

Fracture hospital.—This was also in a fine château on a wooded hill, which was well parked and full of flowers. The wounded were in *Service de Santé* barracks. While every city hospital accommodation was provided under beautiful country surroundings and it was neat, clean, and well equipped, it was too far from the line, and all cases arrived infected. Its capacity was 400.

Visit to the ——— *sector.*—Here the field hospitals were, as in the Sixth Army, frankly grouped as evacuation hospitals. They were, however, still referred to as "field ambulance

groups." One, 10 km. from the front, was fully immobilized in Service de Santé barracks and had a specially constructed operating group. It was as orderly and complete a barrack hospital as one could wish to see, and a feature of the place was its landscape gardening and comfort, even luxury. Its capacity was 1,000, and it received the gassed and the severely wounded. They had female nurses, the usual triage, an exceptionally good deshoeking plant, and operating teams.

The last field hospital I have to call your attention to was at Jouchery. This is destined to be a historic site for military and civil surgeons, for it was here in this little barrack hospital that Lemaitre, the father of the primary suture, bravely worked out under surgical conditions, without radiology or bacteriology to help him, in the face of almost insuperable obstacles, the greatest contribution of surgery to war. It should not be forgotten that it was not in a base hospital, nor even a big evacuation, that this great light to surgical practice was kindled. It was in a modest, even poor, little field hospital within gunfire of the enemy, and it was done by a man who was a plain field hospital man, who had never advanced any claim to being a great civil surgeon. The hospital when we visited it was a tiny affair compared to the splendid big institutions we had seen. It was complete and neat, of wooden barracks on three sides of a court, in the center of which was a Bessonneau tent for the triage, dressing room, preoperating room, and shock room. At this date all of the progress of military surgery was represented—a radiologic room, bacteriological laboratory, etc., but it reminds me of a toy hospital. It bespoke its poverty, but it was clean, cheery, and ornate. I was accompanied by Lemaitre himself, who though promoted to a professorship in the French Medical School, with a huge operating clinic at the H. O. E. of Bouleuse, preserved for it an affection and enthusiasm which was very touching. He exclaimed as we approached, "That is the ideal. Give me a little place like this and my devoted little band of assistants that stuck loyally to me all through the early days of the primary suture, and all alone off here I can do more than if I had the biggest institution in the French Army." There was something very human about this that appealed strongly to me. The big things are often done in these small, poorly equipped places.

At that time M. Okinczye was in command. He had been transferred here from the hospital where we had first seen him. The personnel was 5 medical officers, 1 radiologist, 1 administrator, 1 pharmacist, 42 enlisted men, and 15 drivers. No feature of an evacuation hospital was missing; its capacity was 400. There were two operating rooms. The slightly wounded are classified here as donors for transfusion, but with this exception only the seriously wounded are brought here.

Major Okinczye assembled our student officers in the receiving tent and gave us a short talk on the work of a field hospital in war. It was short, but I believe that it synthesized all that can be laid down as doctrine for the surgical use of field hospitals from the professional standpoint. The field hospital should be primarily for the treatment of the nontransportable; that is to say, for those who can not be moved farther without endangering their lives or seriously aggravating their condition. Such are:

(1) Those suffering from or in danger of a recurrence of hemorrhage, requiring ligature or transfusion, or both. No man should even be evacuated to the rear from a field ambulance with a tourniquet on.

(2) Those with chest or abdominal injuries.

(3) All cases of shock.

(4) Certain compound fractures, especially of the thigh, all of which should be here stopped, carefully examined as to shock and their splinting, and only sent on when it seems safe to do so.

At these hospitals one can not expect to get through without losing at least 30 per cent of the wounded. This brings down the mortality of the evacuation hospital and takes a tremendous load off their operating staff, as they have to spend so much more time on such cases. Besides, as he rightly says, the nontransportable are nonevacuable also and would have to be held at the evacuation hospital anyway. They are also popular with regimental surgeons who, in the confusion and hurry of the front, are unable to handle these desperate cases and unwilling to expose them to a long trip.

Now, gentlemen, we are ready to apply what we have seen—these things that I have cited are facts that we needed before we could really discuss what we are going to do with our own field hospitals. Now take our field hospitals as they are. They are not equipped for this war, but they are being equipped. There are some who think that the field hospital should be a divisional unit and should be looked to to do emergency surgery at the front, and there are many very excellent men here and in the United States—natural leaders in the States in surgery—who say that we divisional people should not be intrusted with the surgical care of the wounded. True this sentiment is not expressed as plainly as that, but it is there. But what are the facts? Are they right about it that we are not equipped; that we haven't got the experience as a class of men? They may be. Some of us, individually, may be very fine surgeons; but, in general, the general practitioner is not equipped to do the delicate work on these desperately wounded men. * It is naturally right and proper that some experience be required of those who are to do this kind of work—that is to say, it is the business of an operating team, or more than one team, at these field hospitals; and it should not be resented by us that we should be required to show our fitness for this delicate surgical work. But we will answer them, as we all will, that we will learn their game; that we are going to fit ourselves to carry on at a field hospital; that we will learn how to do this work from their leaders, through teams. That's the whole question and that is the idea of this school. Surgeons are none too plentiful as it is. I know of one division that organized five teams from their own personnel and had to lend three of them to evacuation hospitals in their rear. We are endeavoring to bring together the base people and the front people, that we may get good cooperation. All the men at the front were at first looked upon in all armies as men capable of handling only emergency surgery that anyone might do, and the men at the front strafed the men at the rear because they said they didn't know anything about the war. And in a way they were both right. We are trying to break that down by bringing these elements into contact, the men at the base and the men at the front, and when we do it we will have a Medical Corps that is an ideal medical corps.

Now these ideas on the field hospital are personal, collected from what we have seen in the course of a year and a half in France. But I believe this is the solution of the problem. If I didn't believe it I wouldn't give it to a class of medical officers. We have four field hospitals. I believe two should be surgical hospitals, one a gas hospital, which, when not receiving gas cases will be receiving men who have become tired out, as a rest station, and the last should be a medical hospital, which will take in not only the current sick but which should have some control over the venereal labor camp, and the hospitals or wards for contagious diseases and skin diseases. If you will look at it in the following way you will understand: Up to the present time, in the 52 weeks of the year, 50 weeks are spent in inactivity and 2 weeks in activity. We should bear in mind that our men should be made comfortable in at least those 50 weeks and in quiet sectors and inactive periods. Conditions approximating civil conditions should prevail under these circumstances wherever possible. We should try to meet the conditions and endeavor to keep men at the front, make them comfortable and keep them from getting lost by being sent back to the rear. The field hospital should be so equipped and so supplied that it should be able to go with its division at a moment's notice, to take part in an advance or retreat, and, when it is stationary, to take care of the sick, wounded, and gassed men to the best possible advantage, and with the proper men and the proper staff it will do that. They are ordinarily immobilized, but when movement comes they should be allowed to cut loose and go ahead. There is only one way to do that and that is to have the correct medical service organization. There should be under the corps surgeon a medical supply depot of an advance nature which should be a receptacle to take care of all stuff of the field hospital which has become immobilized, which should store it and keep it against the day when it becomes again mobilized. Or, when such a thing is feasible, the corps field hospital might come up and take over the hospital which they have immobilized and work it as an evacuation hospital, allowing the field hospital to go on. The field hospital thus loses none of the dignity of its position, but becomes more important than it ever was and is not confronted with the impossible task of caring for all wounded.

Now to get down to bare facts. Our tents are absolutely improper, inadequate for this war. The Bessonneau tent is so far ahead of our tent that there is no comparison; there

is no question about it. The double-walled tent is a warm tent, the single-walled tent is a hot tent in summer, and a mighty cold one in cold weather. The Dixon is a wider tent than the Bessonneau; otherwise they are about the same. They are built on the cantilever bridge style—one portion supporting another. One could be used very well in time of activity as a triage and an office, and this is where they take the men. Why have a dinky little office somewhere else when office work is practically limited in battle to this tent, except if you become immobilized? Another should be used for the preoperating tent where men may be washed up prior to operation, prepared for operation, deshoocked, and transfused if necessary. The other 10 tents are wards. Now in addition to that we have certain other tents. I am going to give you the equipment for these surgical hospitals when they are immobilized and then tell you what things are to be left behind when the field hospital goes into action. Plus the above mentioned tents you should have one large ward tent, old type, for stores; that's the way to use up the old tentage. Another similar ward tent should be provided for a dining room; you should not require the corps men to eat out in the open, and there should be a plain hospital tent for a kitchen and one for kitchen stores. The kitchen should be under cover; the kitchen stores should be separated from other hospital stores, of course. And you should have 10 pyramidal tents for your men. It is perhaps true that they will hold 15 or 16 men, but as a matter of fact that tent will not hold more than 8 or 10 comfortably. You should have 7 wall tents for your officers because you will have more officers in this new surgical hospital than our manual calls for. Our manual calls for 6 officers to a field hospital; 1, the major, has a tent to himself. But to that number of officers you should add those of one or more operating teams. On your operating teams we will have one female anesthetist and one female assistant—we are probably not going to have male assistants to operators. These two girls will have to be put in a tent. Then there is the medical officer of a resuscitation team. Now these resuscitation teams are extremely important. They do nearly as much good as an operating team and they are fully as indispensable. There should be one radiologist and one bacteriologist with the mobile outfit. It is foolish to say you can't use a mobile bacteriological laboratory at the front—you can. The following dependencies are noted only when the hospital is immobilized: A carpenter shop; a machine shop with a "smithy"; a tailor shop to keep your men neat and looking well; a cobbler shop to keep your men well shod; a barber shop; a canteen, and separate from it a recreation hut, which should be furnished by the Red Cross; a bath; a delousing plant, and an office, because when you settle down and are immobilized you want a separate office outside the triage, which is a very noisy place for a steady diet; a laboratory; a feces and garbage incinerator with a bucket latrine, and a pack store, where you take up your equipment and keep it.

Now, this may seem like a lot for a field hospital, but if you haven't got a lot of these things your men are not going to be comfortable in the dreary days of inactivity, as comfortable as you can make them; and these things are furnished universally by the British, as I have seen them. They do it, and the French do it too, and we have got to do it. We are not doing it anywhere near enough, and we have got to do it.

Now, in inactivity—I am talking about when we are not attacking or being attacked—such a place can be kept up as a regular place for the field hospital when the division has taken a certain position, a certain sector; and until that position is changed it should be kept right up, and the corps should keep it up. When the field hospital goes out it takes with it its combat equipment and the outfit replacing it takes the rest of it over and it becomes the property of the next man. A field hospital settles down in a little town, in cellars or perhaps a château where you can accommodate lots of these dependencies or the operating equipment and you won't have to use all your tents. Generally, however, you have to use your Bessonneau tent, your admission tent, and your preoperation tent, and as many ward tents as may be needed to house your patients after houses or barracks are occupied. During inactivity, the post medical supply should be requisitioned—I am saying this advisedly and I am probably going to bring on a storm of disapproval by it. There are plenty of men who say that is theory; that this is war, and you are not back in "posts." I am not thinking about "post" life at all; I am thinking about what I have seen in war myself. They have these things in the French and the British Armies, and the men are more comfortable

by reason thereof. You don't find their men living for 50 weeks in the year on the ground or on these cold metal cots that are as cold as the ground. You don't find them eating in bunches out in the rain from their tins and canteens, with no place to go to get warm when they are cold or chilly. You find them sleeping in iron bunks, with sheets and pillowcases; and you will find there everything a well-regulated hospital should have, and there is no reason why you shouldn't as long as things are quiet. If you can get an instrument case with beveled glass, get it. If it is white enameled, so much the better. The whole supply for field hospitals will have to be revised; it is being revised right now. We have a great many things we don't need, and there are a great many things we will have to have. As it is now we have a field hospital per our Manual for the Medical Department that if taken into the field with the name field hospital attached to it, when it is only a fake hospital, we are not going to do for our soldiers the things we ought to do for them; we are not supplying to the soldier what he has the right to expect when he is in hospital. They are not hospitals; they are merely temporary shelters, with dressing station equipment, and we have got to supply a very different sort of thing for the future. Where everything heretofore has been sacrificed to mobility we have got to make a distinction between those things which we will leave behind in a move until things are quiet, and our absolute needs to provide an emergency hospital of modern type in the field of battle.

Another thing: There has been a tendency in our Army to discourage the equipment of hospitals at the front with certain comforts and certain things that please the eye and soul of the soldier. The Red Cross has been anxious to get these things in, but owing to a good many different conditions they haven't done it yet. This is the hospital where the Red Cross should be allowed to bust itself. They can furnish a lot of things that we can get in no other way, and every one would make a soldier better off. Do you remember what Crile said about the predisposing causes of shock? Cold, lack of comfort, that little by little take away his percentage of safety? And you have the answer right there. These Red Cross people should be allowed to furnish wicker chairs, games, all kinds of medical comforts, including commissary stuff; they should be allowed to decorate wards, to paint, to whitewash, to provide tables, writing materials, magazines, books, tennis balls and rackets, footballs, baseballs, bats, physical culture men if you want them for that period of inactivity. Now when the field hospital is ordered to the front in an advance, the corps medical supply depot can take over all that property not possible to carry and hold it for the unit. In fact the best way is to have a corps field hospital move into and run it as a stationary hospital. It might be possible to simply put a guard over it. A triage tent, a preoperating tent, and 12 Bessonneaus should go with the field hospital into combat. They should go on the same principle that you would transport a heavy gun, and if this augmented equipment is lost it should be viewed in the same light as the loss of big guns. You have got to have the gun to kill boches, and you have got to have your equipment to take care of wounded men so you can fix them up and get them promptly into shape to kill more boches. Your mobile surgical unit, with its equipment and, of course, your operating team goes, and your resuscitation team goes, and your personnel goes. Then you should carry on with you all those things that you know you are going to need in that battle, and somebody has got to sit down and say what should be carried forward and what should not go. For instance, you should carry gauze and cotton and Thomas splints up with you, but you needn't carry any atomizers up with you. Any of you nose and throat men know that, while it might perhaps do some good, it doesn't do enough good to warrant loading yourselves down with such things. Lots of medicines need not go.

We have got to have more of certain things; more and better instruments—no question about that part of it. They ought to have portable deshoeking apparatus, and a number of other things we haven't to-day. Now, that goes forward on the trucks that you have. You get to the place where you are going and you unload. You are going to use these trucks, perhaps, for the transportation of wounded. You don't know how long you are going to be there. The other surgical hospital behind you eventually moves ahead of you when the advance takes place. When there is such an advance the one behind moves ahead and jumps over the one in front of it and establishes itself in front in the same relative position to the fighting troops as the first one had. Then it opens and takes the wounded coming to the

rear off the hands of the first. The wounded in the first hospital being evacuated to the evacuation hospital, that hospital in the rear then moves forward to a point in front of the field hospital which preceded it, leap-frog fashion. This tandem work has been tried out in the 32d Division and has given good satisfaction in the second Battle of the Marne. It seems to be a very sensible proposition. In retreat the process is reversed. Now, when stationary warfare comes on again you can build about you with the aid of the corps surgeon the things you left behind when you were inactive.

In a war of movement the surgical hospital farthest to the front should conduct the whole triage. If your corps surgeon or your division surgeon insists on triage at one place, this is the place to do it. The triage should never be done where you can not apply the remedy to the cases that desperately need it. Otherwise it is an utter loss of time and a destruction of that man's limit of safety by exposing him to cold, to fear, and to chill. The cases that should always be detained at this advance surgical hospital are chest cases, abdominal cases—chest cases will die if you send them back with open wounds—severe compound fractures, shock and hemorrhage. That is taken directly from M. Okinezye's estimate of what this hospital ought to be used for. Here is one of the great arguments for this place: You never have assurance that you can get to the casualty clearing station, to the evacuation hospital, because, as we have seen in this last push, they are left far behind over crowded roads, with scanty transportation to get at them, and desperately wounded men at the front are utterly deprived of the proper sort of help. You have got to provide for that on the way back.

Now we come to the gas hospital. The gas hospital is rapidly taking form under the excellent administration of Colonel Gilehrst. He has an outfit, a portable degassing outfit. There are two of them to a division. It consists of a large 1,200-gallon tank of water, which is really a portable bath, and all the material necessary to do the bathing and degassing of these patients. Therefore the gas hospital should contain 10 Bessonneau tents for the accommodation of your patients—300 by crowding them in on litters—you are not taking beds with you this time—1 large old-type ward tent for stores—got to have that; 1 for a dining room; 1 hospital tent for kitchen and one for kitchen stores; 10 pyramidal tents for men, and 6 more tents for officers and nurses. You may have to cut some of that tentage down especially that for personnel, but you should hang on to your ward tents and receiving tent to do triage in, and the portable degassing outfit. Now when you get settled and things quiet down, that becomes a place where you can send men from time to time for rest, and as a rest station this field hospital should take on all the characteristics we have described for the others, with its cobbler shop, carpenter shop, etc. The number of men is the same, and the Red Cross here should be especially active to provide recreation, games, theatricals, music, comforts, etc. Now in regard to gas, remember what happened in the 26th Division—that only 10 to 15 per cent of the people supposed to be gassed really were, and the rest were only exhausted, mentally and physically. You see the gas hospital is the natural place to have a rest station, and a rest station in the strict sense of the word.

Now we come to the medical hospital. They should have 11 Bessonneau tents—1 for triage and the rest for wards; 1 for kitchen, 1 for stores, 10 tents for the men, and 6 for the officers. Same as the outfit for the gas hospital and the surgical hospital minus the degassing outfit and the surgical equipment, but it should include baths and be equipped to run skin and venereal wards. You can delouse these skin patients, but you want them separated from the others if you can. The medical hospital should have its division consulting physician, and the gas officer should have his headquarters here at the gas hospital. In that way you have within the division the head of the evacuation system offering real hospital conditions of a temporary emergency nature to men desperately needing it and who can get it only with great difficulty otherwise. I believe that is the situation as far as we can develop it in our army to-day in France. I don't believe all of these things are going to be carried out, because I am sure somebody will develop much better ideas than I have; but I believe in general the plan should be followed because it seems to me to be built on facts in this war, and it seems to me to be something which the conditions imperatively demand.

Now that finishes the consideration of the field hospital as far as I am able to give it to you, but one thing should be made very plain. Whenever nearness to the line, good roads, and a quiet sector permit, practically all wounded should go direct to the evacuation hospital

where the triage can be made. To stop a man on the way there is never an ideal; it should be only done in time of stress. Just as an evacuation hospital in a push can not operate on slightly wounded as a rule, which they send to the stationary hospital in their rear, so the desperately wounded when the roads are clogged should be taken care of farther to the front, and here triage must be done to prevent them from being carted to the wrong place or dumped in a confused heap on an overworked central hospital, such as the evacuation hospital comes to be. In fact, in a war of movement and severe operations from intrenched positions, triage is necessary, but it must not be done as it has been done. It needs an experienced officer of the best type to facilitate and not hinder the prompt delivery of the patient to his final destination for definitive treatment. The full 90 per cent of slightly wounded can be sent clear to the general hospital, 150 kms. in the rear, suffer there, from 24 to 36 hours thereafter, a surgical removal of devitalized tissue and the foreign body and a closure by retarded suture from three to five days thereafter, and their wounds will heal by primary intention, but to relieve evacuation hospitals of these cases needs a good triage officer to make it a success.

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THE EVACUATION HOSPITAL

A lecture by Col. Bailey K. Ashford, M. C., commandant.

All that has been said yesterday of the dependencies of the field hospital, its shops, baths, recreation huts, amusements, comforts, and ornateness apply in a still higher degree to the evacuation hospital. In fact the field hospital while stationary in inactive periods is a small evacuation hospital, differing chiefly in its portability, its size, position, and limitation to emergency surgery and medicine. The field hospital stands at the head of that system of evacuation through which alone the man can be salvaged. It is the emergency hospital of the battle field.

The evacuation hospital is the real theater of our professional effort in the field of battle. What is to be done must be done and must be done quickly, and under modern medical and surgical conditions in so far as the terrible stress of war will permit. This evacuation hospital is the pivot upon which the man's life, limb, and future usefulness turns. Here is done the urgent surgery of war, the kind that won't wait—the vital part. It must meet the demands of medical science—words, a show of sympathy, and a spiritless, ignorant imitation of the efficient technique of modern methods of treatment are worthless. They are worse than worthless, for they delude the soldier into believing that he is being handled according to the latest tenets of our profession, when, as a matter of fact, what he would be getting under such circumstances would be a poor substitute. Remember that every poorly run military hospital is a defilement on the field of battle of an ancient and honorable profession and a future menace to our standing as serious-minded, practical scientists among our own people. One is apt to forget that the war of to-day is made possible by the application of the sciences by men who possess every other quality that has gone to make successful military men in all time. If we can not apply the medical sciences to war in such manner that our results will tell against our enemy we shall fall behind all other arts and sciences and be limited to a colorless part in the victory, be limited to that function of saving life and preventing suffering in the individual which is the life of the doctor in times of peace, leaving untouched that great task—the prompt return to our fighting line of men who can be saved for future usefulness to our arms. We are not falling behind the others; we are well in the advance, but we don't want to fall behind. Even in antbellum days we were far on our way to taking an active part through sanitation in the life of the state. To do this we must be something more than doctors, we must apply the medical sciences as military officers, remembering, however, that it is the medical sciences and not the art of war that makes us officers.

The evacuation hospital used to be a mere forwarding depot to the rear. It is still, so far as that considerable number of cases fit to be forwarded is concerned, but to-day much of the surgery that would have been done back at "base hospitals" has moved up here.

There are three great departments to-day in every evacuation hospital: (1) The triage or sorting; (2) the hospitalization of those who have to undergo immediate treatment; (3) the evacuation of those who can be safely sent farther to the rear.

This has been the basic plan of most of the evacuation hospitals in the French and English Armies, but two factors have entered quite suddenly to make it perfectly plain that the organization and scope of this important unit can be modified for the better working of our medical service. These two factors are: (1) The change from trench warfare to a war of movement; (2) the possibility, in a large number of cases, of postponing the removal of foreign bodies and dead tissue to a later date.

Upon the original conception of the evacuation hospital, both of our allied armies were constructing, very near the front, larger and larger centers bearing the name evacuation hospital. The French had units of this sort accommodating 2,000, 3,000, even to 5,000 patients, and the English even went them one better by grouping "casualty clearing stations," their name for evacuation hospitals. These huge plants, equipped not only with the necessary instruments and appliances, beds, etc., but with many comforts and conveniences, were near the front, a distance of 15 to 20 km. They were totally helpless as far as possibility of moving was concerned and were exposed to the normal ebb and flow of a battle front. There was, of course, as there should be, a professional reason for their employment in this fashion, and this was the accepted doctrine that the wounds of this war were all infected and that they should all be operated upon as soon as possible to remove damaged tissue and foreign bodies before infection should get a foothold. It was argued that while humanitarian instinct leads us to give priority of treatment to the graver wounds, the slightly wounded are far more important, inasmuch as they require not only one-fifth the time for their operation but they are in this manner saved to the army and in most instances can be returned to the lines in class A condition without leaving the immediate front, thus shortening their convalescence by primary healing and vigorously reinforcing the fighting troops. The result of this reasoning was (1) an attempt to do as much operating as possible on the less severely wounded cases at the evacuation hospital and (2) the consequent very prompt overwhelming of this unit by force of numbers, inasmuch as there were never enough operating teams nor, for that matter, an adequate hospitalization section matériel to handle such a large number of cases. To complicate matters, it was better to treat these wounded by the Carrel-Dakin technique, as the time had passed for the application of Lemaitre's primary suture. But as time went on it became evident that removal of devitalized tissue and foreign bodies could be successfully accomplished in slight wounds back at the bases and that in a few days thereafter, with the check of the laboratory, these cases could be sutured and would heal by primary intention. Now came the abrupt change to a war of movement. The allied armies lost thousands of beds and many of these evacuation hospitals in the rapid advance of the enemy, and they were all at sea again with all wounded being piled pell-mell back over great distances to the base. It was here discovered on a large scale that less severely wounded men were susceptible of this same operation, which Lemaitre had insisted should be done within 12 hours, 24, and even 36 hours after this reception of their wound. It is now clear that the evacuation hospital should not attempt to operate upon all, but only upon selected cases which experience has proven should not be delayed to reach a base, and that the majority can be safely salvaged farther back. This relieves an impossible military situation for the evacuation hospital, gives it a definite part of the surgery of war to do, and takes a load from it which was daily becoming more burdensome.

Therefore, where previously an evacuation hospital was considered to be insufficient with two or three thousand beds, to-day 1,000 to 1,500, 10 per cent of which serve for hospitalization, can be considered ample in the majority of cases. However, the constantly shifting military situation demands that whatever be the bed capacity and type of construction of these hospitals, their organization must be sufficiently elastic to enable their adaptation to any tactical situation with which we are confronted. It must be borne in mind that every inch of ground in the zone of the army is at a premium, and the nearer the front we get the more valuable it becomes for purely combat purposes, especially in the vicinity of railheads. In consequence our aim should be to reduce to a minimum the amount of space we require for evacuation hospitals—throwing the burden of hospitalizing the wounded as far to the rear as possible without sacrificing the results of treatment. Thus in the case of a rapid advance ordinarily we should push forward at first evacuation hospitals of reduced size, say 400 to 500 beds. However, it is conceivable that a situation might arise, as was the

case at Chateau Thierry, where, owing to the state of roads and the degree of devastation existing, it was better to push forward larger groups of 2,000 to 3,000 beds. This elasticity can be accomplished by establishing somewhere in the rear of the armies a mobile reserve where all medical units are held up on reaching France unless needed for work at some particular place. The question of treating the very slightly wounded at a corps field hospital to which they can be directed, thus preventing their loss from their own units, should always be given the preference provided the military situation admits of such a solution.

Position.—An evacuation hospital should be on the spur of a railroad, away from towns, ammunition dumps, depots, aviation fields, and troop cantonments. It should be off by itself, well marked with large crosses and communicating by a good road with the front. Upon its isolation depends its only real chance for safety against avions, its most formidable enemy. From 20 to 30 km. now is the normal distance from the front lines for an evacuation hospital, the second in the echelon of hospitals in the zone of operations.

Capacity and composition.—It should have from 1,000 to 1,500 beds. It should be portable, a tent hospital, of Bessoneaus and Bessoneau hangars, or their full equivalent (double-walled tents). At this hospital should be packed and ready to move the nucleus of another evacuation hospital with a capacity of 400 beds. This should be complete in every particular; and when the evacuation hospital begins to fall away to the rear of the advancing army, this nucleus should be moved forward toward the advancing railhead by means of truck companies or by rail.

One truck company, or fifteen 10-ton railway cars, or one standard troop train will carry this nucleus, and 100 men can set it up at its new site, as an advance party. In fact, this nucleus can begin to functionate in one or two days from the time its first elements begin to arrive, if the distance is not over 15 to 30 km.

In the meantime the original evacuation hospital can clear itself of cases and gradually move toward the new site, building up on the nucleus to form a complete new evacuation hospital. According to Gen. Cuthbert Wallace, of the English Army, an evacuation hospital in a push can not hope to operate on more than 25 per cent of the wounded that pass through it, at least. Let us consider that 25 per cent of casualties on any one day, excluding dead and missing, will be the maximum per division of 25,000 for which we should prepare hospital accommodations. From the classification of these casualties into (1) wounded, (2) gassed, (3) sick, we have per the recent casualty list of an American division, $54\frac{1}{3}$ per cent wounded, $21\frac{1}{4}$ per cent gassed, and $24\frac{1}{4}$ per cent sick. In the last operations around Verdun the number of gassed was considerably less. This gives on this basis of 25 per cent maximum casualties of this sort a total of 6,250 divided as follows: Wounded, 3,396; gassed, 1,333; sick, 1,521. Calculating 30 per cent of these wounded as recumbent, we have 1,132. The number of recumbent cases which should be operated upon, therefore, will not be far from 400. The decision as to who shall and who shall not be operated upon admits an individual factor so variable as to be unsafe for accurate figuring, but in general we can class these cases as 120 seriously wounded, requiring 6 tables and 18 teams; 180 less seriously wounded, requiring 6 tables and 18 teams; and 100 moderately wounded, requiring 2 tables and 6 teams. Total 14 tables and 42 operating teams, an ideal not yet attained.

We are now prepared to consider the function and equipment of an evacuation hospital.

I wish particularly to harp on the fact that an evacuation hospital should provide for a certain number of cases to be kept there; because if there is one thing that the French and British have both learned in this war it is that a hospital purely for the purpose of evacuation is a failure. It is really the point where most of the big surgery of the war is conducted, and General Wallace is father of that idea in the British Army. This is not so with us; I have been through some of our evacuation hospitals where they would like to carry that out and where they haven't been able to do it, and I fear that some of them don't know that it is really necessary. Now, the rest station is a sort of a buffer for the casualty clearing station or gas hospital; if the latter isn't too full of gas cases it can take up some of these exhausted fellows and keep them off the casualty clearing station. The evacuation hospital is a sieve and can treat all kinds of cases. It should have a separate gas quarter; some think that all gas cases should be treated at the field hospital, but that isn't always possible; many of these fellows will go to the evacuation hospital of their own accord. All that I have seen have had

a quarter for gas cases, with adequate provision for their treatment—all the evacuation hospitals, British and French. As to the number to be hospitalized, it depends entirely on how much of an attack it is; on how many of these cases that are operated on stay there the full time. The more serious cases operated upon ought to stay there two weeks, or until the stitches can come out. But owing to the tendency to operate on too many, they stay there sometimes only four or five days. In general, in a chest case, and abdominal case, a knee joint case, if they stay five days you might take a risk and send them back—it certainly is not recommended. Brain cases, if they are operated upon, where they should not be, at the evacuation hospital, require a long time before they can be transported. The minimum is 10 days. The compound fractures of the thigh should stay there as long a time as you can keep them, of course. But in evacuation hospitals men have often operated on chest cases and abdominal cases and have had to send them away in 24 hours owing to the enormous throng of wounded. Of course, this isn't right, but in such a case you have got to make room for the people pouring in. Now, as I have told you, an evacuation hospital ought to hold about a thousand cases—I am speaking about the evacuation hospital of the second echelon of the evacuation system, the one that receives the general wounded, not the one that receives the slightly wounded. Tuffier has shown that a French division will have from 400 to 500 casualties the first day, 200 or 300 the second day, 200 to 150 the third day, and so on. As our divisions are so much larger, a thousand beds are not too much. At Vimy Ridge they had 8,500 go through the casualty clearing station in 5 days. We have seen that the English tend to group these casualty clearing stations together—three or four in a group. I saw one of 10,000 beds at a Canadian center, and they are a good deal like us. It was a nice hospital, first class, a hut hospital, but too large and too near the lines. They can be either of huts or Bessonneau tents. I think they should be Bessonneau tents in the second echelon and huts in the third. The English combine them because they say they economize on railroad service; they economize on X-ray equipment. But it isn't equipment so much as operators. They have had a hard time getting them. Sometimes one radiologist will actually serve two hospitals. It saves laboratory equipment; one laboratory will do for three or four hospitals. It saves on water, fuel, and light, of course.

THE ENGLISH CASUALTY CLEARING STATION

The approach to an evacuation hospital for the reception of patients.—The approaches are by hard roads, as I have said, and the hospitals are within easy reach of main metal roads and railroads. The entrances are in the form of an arc, entering by one side and going out by the other. When an attack takes place the ambulances arrive in convoys. When they get to the triage of the casualty clearing station, which is generally three long tents, one for "sitters," one for "lyers," and one for "pack store," as the English put it. The entrance is often double, triple, or even quadruple in width. This is so that four of them can get up in one line and unload at once. There is usually a big electric light with a reflector there to facilitate the unloading. At the gate as the ambulance passes out the driver hands the little receipt which the receiving sergeant gave him stating how many blankets, litters, hot-water bottles, etc., were left with the patient, and as he passes out the gate this amount of property is loaded on, so that when he goes out he is refurnished the things he brought in; in this way the front is not depleted of its stores. The driver's word is taken for it without receipt in our Army, a better way.

Now, the sitters. They go into the reception room, which must be well heated, and the field medical card which should have been begun at the A. D. S. is examined. If it has not been begun there, it is begun here. This is the place where the man gets antitetanic serum, if he hasn't gotten it already—only about 1½ per cent of the men that come in have not had it. There should be a buffet here with both hot food and drink. The bureau of admissions of the evacuation hospital makes out a slip which differs in detail for the different armies, but in general they are the same. They give the name, organization, and diagnosis, and always a serial hospital number, which is a local affair. His kit is taken away and sent to the pack store, and that number goes to the pack store on his equipment. In the English Army they make identical notations on the stub. The stub they pin to the man's field medical card; the slip itself goes to the record office of the hospital and is entered in the admission and discharge book.

The sitters are divided into those needing dressings and those needing only food and heat before being evacuated. Those men that can go out right away are not given a bed at all, but the former have their kit taken away and are given a bed until they are ready to go.

The dressing room.—That is just beyond. There is a good practical surgeon here, and on him devolves the duty of saying whether a man stays or is evacuated at once. It takes a man of keen judgment and quick perception; he must be a good diagnostician. In this dressing room they dress all small wounds. Those needing operation are sent across to the recumbent side. The patients whose condition is bad are sent to wards.

Now, the recumbent. The recumbents are admitted to a somewhat larger reception room, which holds 50 or more, but never less. I have seen these places overflow with men lying on the ground. Just at the beginning of the fight before Amiens—we were up at Choque—they were commencing to receive a lot of wounded and we saw the advantage of having a large reception room. Here his kit is sent to the pack store. On the other side, you will remember, it was sent to the Thresh sterilizer and brought back to put on. Blood-stained or irreparably damaged clothing is destroyed. The officer here should be fully as capable a man as the other on the "sitter" side. If operation is not needed the man is dressed and sent to the ward for evacuation, because many of these lying wounded can be sent on farther. If operation is needed, he is sent to the preoperating room; if he is in shock or his condition is desperate he is sent to the resuscitation ward. That is near by.

Now the preoperating ward. The English have a nursing sister in charge of it. There the man is bathed and the wound prepared for operation. Of course, this man has been badly wounded; his clothing is taken off; they heat him; and then a team on duty here—generally the team that has just come off operating-room duty—directs his preparation and decides when the man is ready for operation, or it may be left to the receiving officer. If morphine is necessary it is given here; also gum arabic solution. Blood transfusion is usually done in the resuscitation ward, but it can be done here. First the case goes to the radiologic room and gets his shell fragments localized; then he goes to the operating room. The operating team consists of 1 operator, 1 assistant (it should generally be a nurse), 1 anesthetist (also preferably a female nurse), 1 clerk, two orderlies, and 2 stretcher bearers. Remember what Crile says: The best anesthetist he knows is a neurasthenic female with a high sense of responsibility. The English have three teams in a room, working at the same time. This English system is very good. If you understand this you have something to work on. They have a compartment in that room for each team. There are 2 tables; 1 case for dressings; 1 case for instruments; and an anesthetist table; and an instrument table between the operating tables. They have a screen between each two tables; while you are operating upon one man the other is being anesthetized—he can't see the operation and get a psychic shock. As soon as you finish you transfer the screen over to the other side of the instrument table and another patient is brought in and anesthetized. They keep alternating in that way.

Three teams working by day and two by night can handle 120 cases in 24 hours. In times of activity they are reinforced by extra teams which bring equipment with them if necessary. Each English team operates 12 hours, at a stretch, spends 4 hours visiting the cases, and sleeps 8 hours. Pretty strenuous. When a man goes into an operating room he goes in there with his boots tied to a litter and his Dorothy bag. The man who takes the notes—the recorder—is responsible that nothing is taken from that Dorothy bag while the owner is under the anesthetic. They never know the extent of the wound they are going to handle until they operate. A man may have an abdominal, a chest, or a thoracic-abdominal wound. You never know exactly where the man is going until they get through with him in the operating room, but in general they try to fill up the farthest evacuation ward first if the man is liable to be evacuated; only here are beds for hospitalization assigned, not in the reception room. All wards in an evacuation hospital for English wounded are divided into bed wards and litter wards. The litter wards are for those that are operated upon and can be evacuated. The bed wards are for those who can be hospitalized. The officers' ward is separate, of course.

Ambulances coming in from the front are to be loaded with 4 recumbent and 2 sitting; there should be 2 sitting wounded sent with the recumbent cases to render help in case of necessity, and besides utilize the extra room.

THE BRITISH CASUALTY CLEARING STATION

Casualty clearing station 18.—This was a Marquee tent hospital well laid out on the banks of a canal in a well-shaded park. It was very orderly and the grounds were in excellent condition. The tents were joined together in sets of 3, making wards holding 30 bed patients and 50 stretcher cases. Wards were joined by covered passageways, heated by stoves and lighted by electricity, but were dark by day. The floors were of wood, covered by linoleum. The beds were of enameled iron, with wire springs, and well made up with mattresses, pillows, pillowcases, blankets, and sheets; they were clean and smart. Each ward had one end which was a lounge, with easy chairs, books, and many comforts. Each bed had a bedside table. Plenty of fire buckets were seen, as the danger from fire in tents is great. Tents are much warmer than barracks it is said, but Nissen huts cost £50 and accommodate 20, while the marquee tent costs £120 and only houses 10; besides, they last only one year and a half.

There was a delousing outfit with a horse-drawn Thresh disinfector, bath, and a drying room. The kitchen was in excellent condition, a frame building with brick floor and open on one side. It was well whitewashed weekly, tarred outside, fitted with Soyer stoves and an improvised range with 16 ovens, the ovens being simply metal containers about the size of a bread box of fair proportions, with a door. They were issued as part of the field equipment of the old British field ambulance. This entire range was improvised of brick and mud. They had roast meat twice a week and stew three times. All utensils, like knives, ladles, etc., were perfectly clean and hung up; all utensils and appliances not in constant use were stored. The cooks wore white uniforms and caps. Most of the garbage was generally given to farmers; any excess was burned in an incinerator, which was used for this purpose in common with the latrine not far from the kitchen.

The latrine was of the MacPherson type. It was said here that its working was perfect, but it was only good for small commands constantly under supervision. A pail was kept here reserved for men with diarrhea.

The operating theater was in a barrack with white enameled walls and exceedingly neat. It was furnished from the Cowell-Wallace operating team equipment carried on a truck and was lighted by electricity, but had acetylene fittings for emergency.

The pack store was at the side of the receiving tents. It had 100 complete changes of clothing; the equipment and rooms were kept in order by an ordnance sergeant and were very clean.

The method of loading a train depended on the entraining officer, who was usually a dental officer. Ten minutes before the train left its commanding officer was given a correct list of patients. They were loaded in the following order: Carrel cases, serious recumbent, sitting, mental diseases, and infectious diseases, which were isolated. They were loaded rapidly in bunches of six, the best of care being taken not to load a man that might die en route as the responsibility fell directly on the hospital in such cases and was judged with great severity.

Casualty clearing station 23.—This was also an old-style casualty clearing station modified for use in this war and was in tents. As it was not on a railroad and they therefore had to evacuate to casualty clearing station 18 by ambulance 4 miles, it had become practically a rest station and a hospital for ophthalmic and gas cases. It was a perfect model of good administration, was clean and attractive, and in grounds of an old château on a high hill. Its commanding officer was Lieutenant Colonel Safford, who lectured to us on casualty clearing stations at the British school for instruction of medical officers at the first session of this little board with a school.

The clerk taking the "particulars" had a little board with a strap for his wrist to facilitate his rapid writing.

On the side of the dressing room for lyers was seen what Colonel Safford calls his "fire-alarm box." This was a biscuit tin with one side removed and replaced by paper pasted over the opening. It was hung up on the wall and served to furnish at all hours of night and day sterilized instruments and dressings for immediate use. These biscuit tins contained: (1) Tourniquet, (2) rubber gloves, (3) tracheotomy tubes, (4) hemostats, (5) scalpel, (6) scissors, (7) trocar, (8) hypodermic syringe and needles, (9) surgical needles, (10) silkworm gut, (11) dressings. When this box was needed the hand was simply

shoved through the paper and the instruments needed were removed, thus avoiding the confusion of hunting for instruments and dressings separated by distance and confused with a large amount of material for other operations. As soon as used, the hole in the paper attracted the attention of the orderly who was in charge and he replaced it immediately by another and similar biscuit tin.

The preoperation room accommodated 40 to 50 patients. Here, they were washed, put in pajamas and warmed. The operating room was white painted and clean, and was furnished with a Cowell-Wallace operating-room equipment with its furniture. All of this equipment was put on a trailer, within an hour, when the team was called to operate in some other casualty clearing station in an emergency. Among things noticed in this room were enameled iron tables with glass tops, folding operating tables, a separate operating table with a compartment underneath the table top for heating by means of electric lights in case of operation involving shock. There was a traveling tank filled with an irrigating solution swung overhead on a wire, with a trolley which served all of the tables.

There was a department set aside for the 60 cases of chronic gonorrhea which had been sent here to do the rough work around the hospital. They were housed in tents, had their own bath, latrines, and dispensary, and constituted practically a venereal camp within the hospital. We noticed an open shed with tables for the passing of sounds and irrigations of urethra by permanganate solution. It was most cleanly and well whitewashed.

The latrines here were also of the MacPherson type. The pack store was in charge of a quartermaster who was commissioned in the Medical Department and had been a hospital sergeant of long service. Here, only 50 changes of clothing were kept. All officers leaving the hospital were required to sign a statement that they had received all of their property. The laundry was given out to civilians. The ward beds were furnished by the British Red Cross, as were most of the comforts. We noticed chairs, tables, and reading material, etc. The officers' ward had 18 beds, a good stove, a lounging room, a washroom, and other things connected therewith. We were told that stretcher wards held 24 patients.

There was here a large shed well whitewashed, with cement floor, and open on one side for gassed cases. This held 54 stretcher and 8 bed cases. The beds and stretchers were arranged in clumps of 4, with the head turned toward the Haldane oxygen apparatus. This was only used in the summer time, a barrack being used for this purpose in winter. All gas cases were treated as recumbent cases.

The following casualty clearing stations were large, modern, and generally of wooden barrack construction.

Casualty clearing stations, Canadian sector.—Here they were building three enormous casualty clearing stations chiefly of Nissen tents. Each one was to hold 2,500 cases.

Group of two casualty clearing stations near Arras (Casualty Clearing Stations 57 and 30).—These were British and represented the most advanced type of casualty clearing stations. One was chiefly of Nissen huts; the other was partly composed of tents. Their capacity was a thousand apiece. There was a large number of machine dumps and repair shops in the immediate vicinity which had been recently grouped near it. Here, we found that the Marquee wards held 44 patients and the Nissen 20. The Nissen hut was hard to heat, and in one we saw a very good stove of the old Franklin type built of cement. This hospital was excellently built and the wards were lined and floored with tongue and grooved lumber, as well as being well painted. They were models of cleanliness and comfort, had linoleum on the floor, and a louvred window ventilator the length of the building.

The baths were excellent. While tubs were used, the main dependence we placed upon the shower baths, which were furnished each with a large rose shower head. The water was heated by a very substantial upright boiler with a hot-water reservoir above and cooling tank arrangement on the side. It was far more substantial and better than the French system, but more bulky, heavier, and required more water. There were 12 separate shower heads, "secours aux soldats"; four could bathe under each shower head at one time, giving a capacity of 1,000 in two hours. This was a bathing center for the corps, and the British make a "parade" of it, or a "formation" as we call it. Every soldier in the British Army was said to have a bath every 8 to 10 days. The outer clothing was disinfested at the same time and fresh underclothing issued. There was a separate bath for skin cases.

The latrine used here was of the bucket and incinerator system.

The laundry was taken by civilians and gave a great deal of trouble.

The operating group was in Nissen huts, well lined with tongue and grooved lumber, well painted, well furnished, heated, and lighted. Surgeons operated 12 hours, spent 4 hours visiting their cases, and slept 8 hours. They counted on having two teams for every 100 admitted, which meant that they operated on slight and nervous cases at this hospital. There are six such teams here at present. They keep three medical officers in the reception and dressing room, two in the resuscitation room, and one in training. The personnel have a ward, one nurse, and three orderlies. The two hospitals had one radiologist and one bacteriologist in common.

The kitchens were models of cleanliness and their capacity was 500 meals apiece. They each had a Nissen stove which bakes for 500 men. This model is found in a detailed description of this hospital ("Visit to English casualty clearing stations Army Sanitary School"), and it heats, in addition, 120 gallons of water a day. Another kitchen range has pipes running through its fire box to supply a hot-water tank tapped for the ablution benches. The incinerator for the latrines was near the kitchen and heated water for the washing of dishes in the same manner. The Thresh sterilizer was housed and its smokestack laid across the ceiling and heated the drying room.

COMMENTS ON THE ENGLISH CASUALTY CLEARING STATION

I have not seen the casualty clearing station since the change to open warfare, and it is said that certain changes of a radical nature have been made, but is very evident that in general such a hospital would be defined as a stationary hospital as described in our antebellum literature. It is not portable enough, generally too close to the lines, and seems to be usually a collecting point for adventitious groups of war supplies for which the Medical Department can in no way be blamed, but which must have been the excuse for the terrible bombing expeditions of casualty clearing stations which horrified the civilized world.

Another comment, in the line of what we know to-day as self-evident, is that such a hospital operates on too many cases; and the converse of this, that these operating groups are much too unwieldy. The Marquee tent is strictly inferior to the Bessonneau. No practicability can be considered without a tent installation. It is unnecessary to testify to the evident excellence of these hospitals in their administration, equipment, comfort, decency, and good surgical personnel, as well as to call attention to self-evident schemes which improve the efficiency of these institutions, such as Colonel Safford's fire-alarm box.

THE FRENCH H. O. E. (HÔPITAL ORIGINE EVACUATION)

H. O. E. 32.—At Mont Notre Dame. This hospital fell into the hands of the enemy a few days after we visited it. The nearest point to the firing line was 15 km. It received its patients direct from all formations to its front, battalion aid posts, G. B. D., special surgical hospitals on the battle field, as well as field ambulances. Its capacity was 3,380, expandable to 5,000. It was a barrack hospital in excellent condition and built on the ruins of its predecessor destroyed by fire only five months before.

The water supply is from the abbaye of Mont Notre Dame on a hill near by and is piped to four large tanks in the center of the cantonment, where it is centrally hypochlorinated.

All huts are revetted up to about 3 feet, the roads are macadamed and well guttered and the place is cheerful and attractive. We understood it had a twin hospital near it.

Triage: This did not differ from the accepted plan in all armies except that there was a secondary triage in all three quarters of this hospital; that for the wounded, that for the gassed, and that for the slightly wounded.

The operating groups: There were 4; 2 were for the hospitalization quarter with 880 beds, 1 for the slightly wounded, and 1 small but complete one for prisoners of war. Each hospitalization group comprised three barrack buildings for triage and preparation for operation, a hollow square of buildings for operating, and a group for personnel, laboratory, stores, etc. All were connected by protected covered ways.

The preparation of the patient consisted in a general bath and removal of clothing in one room; here the wound itself was not touched. Next to this was a large room with beds

for the storage of cases preliminary to their reception into the preoperating barrack placed between the two. The clean patient is now transferred by a covered way to this latter barrack, where the wound itself is prepared. The preoperating room proper is connected directly with hot shock rooms elaborately fitted up with electric-lighted hoods, transfusion apparatus, etc. They divide their shock cases into those with nervous shock and those with shock due to hemorrhage. The first receive saline solution, the second blood.

Once prepared the man is carried by litter bearers by means of wheeled litters to the waiting room for prepared patients and from there to the X-ray room, which also has its reservation for waiting cases. In the center of this operating group and communicating with it directly by windows was the sterilizing room, fed by the sterilizing truck of the auto-chair, backed into the opening cut in the wall for this purpose. At the time this sterilizing truck was an auxiliary to the central sterilizing plant which did the main part of the work of sterilization for the entire hospital. On either side are 3 operating rooms, each with 2 tables; 1 of each 3 was kept for septic cases.

In the far end of this group was the X-ray photograph plant, storerooms, rooms for personnel, laboratory, pharmacy, etc. The laboratory was a field mobile affair, very practical, and presided over by an efficient bacteriologist. His equipment was packed into six small chests, but he nevertheless kept a bacteriological numerical chart of organisms per field of the microscope for each patient as well as an accurate qualitative description of the principal organisms in each wound, anaerobes as well as aerobes. His procedure was simple enough and consisted in sowing from each case at the first operation and thereafter p. r. n. He sowed one single agar slant for aerobes, one Veillon agar tube for anaerobes, and a third Vignal capillary tube filled from a diluted Veillon agar tube. His charts for each case looked like fever charts and were kept with great precision and detail. Attention is invited to the fact that the radiologist and bacteriologist form part of the operating group. During a push the bacteriologist was utilized in the operating room. There were two such groups practically exactly alike.

The central sterilization plant: This has proved to be a great time and personnel saver and has been adopted in the French Army to unburden the overloaded operating groups. The main essentials are:

1. A large Geneste-Hercher steam sterilizer with cages holding a large amount of dressings.
2. A preparing room for dressings where nurses make packages of gauze, cotton, sponges, abdominal pads, etc.
3. A place for the assembly of sets of instruments for "ephussage," scalpels, scissors, rubber gloves, glass syringes, needles, etc., with their distribution into small tin boxes ready for sterilization.
4. A place for the sharpening of knives and scissors, repair of rubber gloves, etc.
5. The store of raw material for dressings.
6. A store and distributing room for the sterilized material.

Instruments and gloves are sterilized in the same box with 200 gm. of formal sprinkled in gauze over them and at a temperature of 80° for 45 minutes. Compresses of cotton, dressings in general, and operating-room linen are subjected to 134° C. for 1¾ hours in the autoclave. Sealed capillary glass tubes filled with sulphur containing a trace of methylene blue are wrapped into the center of each package and if the desired temperature reaches the interior this fact can be evidenced in using the dressing by the beautiful ultramine blue this mixture makes on reaching a sterilizing temperature.

This plant was remarkably efficient, neat, and quick.

Gas quarter: This was of Bessonneau tents and wooden barracks, with a capacity of 550. They were sorting here into the asphyxiated and the vesicated. The asphyxiated were taken direct to a barrack ward with 40 iron bunks. Running along the whole length of the tent on one side was a pipe system connected with a large oxygen tank which was tapped at the head of each bed for a rubber tube controlled by a Mohr clip and terminated in a rubber funnel. Each patient on this side thus received oxygen; the other side was for those not needing it.

The vesicated were admitted to a long barrack building floored with cement. In the first room they were rapidly disrobed, the clothing thrown out of the window on a cement dump outside through a flap door. They were then sent to the next rooms for their alkaline shower bath and their hair cut. Here there were 16 showers. The next room was devoted to alkaline sprays for eyes, nose, mouth, throat, and sitz baths for the genitals. Gomenol oil (10 per cent) was used as a spray for the nose and throat. In the next room patients were dried and given clean clothing; here was a shock room. In the last room, a rest room, the history is taken and they are sent to wards.

Section for salvage of dressings: This was in a concrete-floored hut. There was a room for bloody and muddy litters, cleansed by hose. Another room contained a series of tubs for gauze. Soiled gauze was soaked in cold water 24 hours, then 24 hours in a solution of 1 to 1,000 chloride of lime, then 24 hours again in water, then boiled in a large stew pot, then laundered and folded, and finally sterilized in a Geneste-Hercher at 134° C. for 1¾ hours.

Cotton was picked over, the soiled portions burned and the rest sent to a salvage depot for recarding, sterilization, and issue.

Advance medical supply depot: This supplied all medical organizations in front. It held 20,000 gas masks as a reserve and supplies for six months.

Hospital garden: This yielded 20,000 francs a year.

Quarter for prisoners of war: This was complete and extremely neat, and consisted of Bessonneau tents, a Bessonneau hangar, and a small operating group.

Quarter for slightly wounded: This consisted of a Bessonneau hangar and an operating group from which patients were stored in evacuation wards as attended to. The arrangement of this hangar was the most complete and the best I have ever seen, and all medical officers should possess a plan thereof. It is furnished in the description of this plant (H. O. E. 32) issued by our school. Here the slightly wounded were all gathered, made to sit on benches in an orderly manner, and were bathed, given hot drinks, dressed if necessary, and booked in. It communicated with the operating group adjoining, where such as needed operation before evacuation could be handled. The hangar held from 300 to 400, as per diagram, and the operating group could handle 450 operations in 24 hours. Considering 15 per cent as needing operation, this means that about 3,000 could be put through in 24 hours. Slightly wounded were defined here as were all those (generally able to walk) in whom there was no wound of a large joint, or fracture of thigh, leg, humerus, or skull, or wound involving any of the splanchnic organs. As soon as these slightly wounded receive attention, they were sent for evacuation to the evacuation wards near the railway siding. There were wards with litters and the wards with beds and Bessonneau hangars for sitting wounded in which to await the next train. But the French do not leave a recumbent patient to await a train on a litter for any length of time. They put him to bed and shortly before the train is due they transfer to a litter and fill these litter wards. In active periods they have at least two trains a day, which report automatically.

Other details of this hospital: The latrines of the hospital are inadequate. The kitchens are orderly and the food good. In fact a cooking school was in session here at the time of our visit.

They had an excellent Red Cross recreation hall. There was a group of centers, one each for a stomatologist, ophthalmologist, and otorhinolaryngologist. All had dispensaries, operating plants, and wards in the hospital.

The mobile evacuation hospital: In one large Bessonneau hangar was stored one complete reserve evacuation tent hospital, which it completely filled, with accommodations for 400 patients. There are four of these per field army. They are complete down to the last pin, with Bessonneau tents, iron bunks and bedding, X-ray apparatus, instruments, etc., all packed and ready to go at a moment's notice. The hospital consists of 4 Bessonneau hangars and 32 No. 2 Bessonneau tents. The personnel is 200, which in a move is split into a group of 100 to forward the hospital and 100 to receive and set it up. It requires for transportation thirty 10-ton railway cars or 100 motor trucks, and the time required to transport it 15 km. and set it up is 8 days. The hospital thus transported could functionate in one or two days from the arrival of the first element.

In a push, 120 medical officers were needed, but only 40 during quiet periods.

GENERAL DATA CONCERNING H. O. E. 32

This hospital was one of the best we have seen, the most complete, the best administered; but it would have been termed "a stationary hospital" in our Army. In fact the French so consider it, and it is really the last échelon of their evacuation hospital system; or to put it more correctly, it is an evacuation hospital of the third echelon, the first being a divisional one, the "field ambulance"; the second, the H. O. E. of the corps. It retained for hospitalization the nonevacuable, all who can be returned to the front in four or five weeks, and certain gassed cases.

The hospital stands alone, no ammunition dump or depots being near. There are large black crosses on a white background, marking it against avions, whose dimensions are 30 m. from tip to tip.

There is a barrack for the triage of sitting and another for the recumbent and a hangar near by in case of a rush, accommodating 200 lying or 500 sitting.

Composition of the hospital

22 wards, 40 beds each, for hospitalization.....	880
Evacuation lying, 20 wards, 40 beds each.....	800
Evacuation sitting, 20 wards, 50 beds each.....	1,000
For écloppés and vesicated, 5 wards, 50 beds each.....	250
3 Bessonneau hangars, vesicated and prisoners of war, 50 beds each.....	450

Personnel.—Three auto-chirs (39 officers and 102 men), 20 surgical teams (40 officers, 60 enlisted men, 10 field ambulances (80 officers, 380 enlisted men), section of evacuation hospital (12 officers, 52 men); reinforcement H. O. E. (12 officers, 250 men). Specialists: Stomatologist, otorhinolaryngologist, and ophthalmologist, 3 radiologists. To these add, for litter bearing, 240 territorials. Automobile transport, 60 enlisted men; supply train, 42 chauffeurs; female nurse, 104. Total about 1,500.

Service of an operation table provided for by 2 teams: Team No. 1, 5 a. m. to 1 p. m. and 9 p. m. to 5 a. m.; total, 16 hours. Team No. 2, from 1 p. m. to 9 p. m.; total 8 hours. Next day team No. 2 takes the 16-hour day and team No. 1 the 8-hour day.

Average number of patients operated upon per table per 24 hours: Badly wounded, serious, 20; lying wounded, 30; sitting and slightly wounded, 100. Six tables for hospitalization yield 120 operations, serious, in 24 hours. Six tables for lying wounded to be evacuated yield 180 in 24 hours. Six tables for sitting wounded, slight cases, 600.

They could thus operate upon 900 wounded in 24 hours.

The commanding officer of the hospital, in liaison with groups of field hospitals of the corps and with the fourth bureau of the general staff, requests mixed trains in case of necessity for élopés, or permanent trains for wounded (here used in sense of slightly wounded and sick). He also establishes liaison with the regulation station, through the "commissaire sanitaire" regulating center, and with the centers to which he must evacuate in the line of communications when the operative capacity of this hospital is exceeded. In addition he confers with the chief surgeon of the army.

Triage means reception and inscription of these patients admitted and their distribution to different quarters for hospitalization or evacuation. The medical officer in charge of these services sorts them into:

First. Sick: (a) Those with acute diseases not contagious; (b) tubercular; (c) venereal and cutaneous diseases; (d) contagious.

Second. Nonevacuable cases, sitting and lying.

Third. The écloppés.

Services of evacuation.—Ward surgeons decide when a man is to be evacuated. They may be sent: First, to formations in the zone of the interior, (ZI) or zone of the army (ZA); second, evacuated on special sanitary formations in the vicinity (contagious diseases, venereal diseases, fractures, etc.); third, may rejoin their units at the front after treatment.

Evacuation by sanitary train.—a. Permanent sanitary trains (T. S. permanents). All the gravely wounded are transported to Paris.

b. Semipermanent sanitary trains (T. S. semipermanents). For wounded and sick, sitting and lying, to ZI or ZA.

c. Mixed improvised sanitary trains (T. S. improvises mixtes), sitting or lying; only for intensive periods.

d. Ordinary commercial trains for *éclopés*.

The semipermanent trains ZI receive all who can not be returned to the line within five weeks, either French, foreign, or prisoners of war.

The semipermanent trains for the zone of the army carry all sick or wounded, sitting or lying, French or foreign, that can go back to the line within five weeks.

The commanding officer of the H. O. E. requisitions trains from the regulating medical officer and the regulating station of the army. The call states: First, the category of train desired; second, its composition (number sitting or lying); third, its destination—ZI or ZA.

Except in a push the evacuation hospital does not make special requests for trains, but sends to the regulating medical officer by telephone every day at 4 o'clock p. m. a statement as to the number of evacuable patients.

When the bureau of evacuation of the H. O. E. receives announcement of the next arrival of a sanitary train, they advise the ward surgeons to prepare their sick and wounded which are to be evacuated from the wards by the bureau of evacuation and conducted to the evacuation wards near the railway. There a medical officer sorts these cases as follows:

First. According to destination: (a) Sick, (b) wounded, (c) cases requiring a specialist's attention.

Second. According to mode of transport: (a) Sitting, (b) lying.

Third. According to character of patient: Officer, foreign, Mussulman, native.

Evacuation on sanitary formations of the army to special ophthalmological, orthopedic, contagious, psychopathic, or venereal hospitals, accomplished by automotive ambulances, the motor ambulance convoy, the "S. S. A." of the French.

The pharmaceutical service has charge of the central sterilizing plant, general hygiene, salvage of cotton and gauze, manufacture of ice, superintendence of gardens, and the proper distribution of drugs and medical supplies in general. It runs three separate services: (1) The central pharmacy of the hospital; (2) the special pharmacy for the specialists and infirmaries; and (3) the reserve supply of drugs.

H. O. E., BOULEUSE

This was a hospital of the third echelon and the seat of the French Army medical school for officers at the front.

The capacity was 3,000, capable of expansion to 4,000. It was an Adrian barrack hospital, isolated from dumps, etc., on a spur of the main railroad. There were two operating groups, one under Le Maître and the other under Leriche.

The bureau of admissions.—They received no gas cases, but had a service for wounds of soft parts, chest, genitourinary wounds, and medical cases. One of the most interesting features of this hospital was its triage, which is a type of the triage of these H. O. E's. The personnel consists of a triage officer, one sergeant in general charge, 2 sergeant secretaries, and 4 litter bearers. They kept two sets of admission books, one for odd and one for even numbers, to economize in time. The book called the *carnet de passage* is composed of sheets perforated to give 10 slips, one for each of 10 men, and the entries are triplicated by carbon paper. These slips, when torn out, contain the man's hospital number in series from hospital enumeration, his name, organization, diagnosis, etc. One slip accompanies the man, one goes to the office of the bureau of admissions and one to the War Office.

A register of entrance, taking up a whole page, is also made in triplicate as above; one goes to the man's regiment, another to the surgeon general of the army, and the third remains on file at the hospital.

In this barrack was a dressing room for emergencies and a buffet serving hot food and drinks, but usually the man was simply booked in and sorted by his diagnosis tag or "*fiêche*." No other sort of triage was desirable nor possible, as the main object was to get him promptly on the operating table where the real and final triage was done.

The bureau of evacuations.—This was in the main office building and occupied adjacent quarters to the central bureau of admission. The personnel consisted of 1 medical officer

1 officer of administration, and 2 teams consisting each of 1 sergeant and 4 men, 1 for day and 1 for night work. This personnel checked all patients in the hospital at 8 a. m., at mid-day, and at 6 p. m. They determine the total number present and the number of evacuable and nonevacuable patients. The evacuable are further classified into recumbent and sitting. Only patients who can not recover in four weeks are sent back in times of inactivity. In time of activity all are evacuated that can be; in time of inactivity, they keep all they can.

Specifically, these are, in time of inactivity:

1. The transportable sick and wounded not possible to hold and curable in less than four weeks—to the zone of the army (Z.A.).

2. The sick and wounded needing more than four weeks for their cure—to the zone of the interior (Z. I.).

3. Those cured at the hospital—to rejoin their corps directly after a leave of 10 days.

At the time of our visit the period was one of exceptional activity and all were consequently evacuated into the zone of the interior, except (1) those who can be cured in 10 days, (2) the nonevacuable, (3) those having venereal or other contagious disease. This hospital could evacuate 3,000 cases a day. The information concerning the state of the hospital was transmitted by telegraph to the chief of staff, fourth bureau, headquarters, and a duplicate sent the regulating officer of train.

A large blackboard was displayed in the corridor of the bureau of evacuation giving particulars of the actual state of the hospital since the last census taken by the evacuation administration staff, as just described. The headings on this board are as follows:

ZIELA. Meaning zone interieur eloigne legers assis (zone of the interior, distant, slightly wounded, sitting cases).

ZIELC. Same as last meaning, except last word, which is couchés (recumbent).

ZIESA. Same but last two words, meaning "serious sitting" (serieux assis).

ZIESC. Same as last, except last word meaning recumbent (couchés).

ZIRA. Last two words mean near by (rapproches), sitting (assis).

ZIRC. Last word meaning couché (recumbent).

T. B. Signification not known.

G. Guéris (cured).

Éclopés. All those suffering from sickness or injury not a battle casualty.

Scabies.

On leave of absence.

All from T. B. generally are evacuated by motor ambulance, save those cured and on leave, who go by train to their units or homes.

Finally there is a recapitulation of the evacuable and nonevacuable arranged according to whether they are French, allied troops, or prisoners of war.

From all this the entraining officer makes up the train. This train is made up on a folder in which is pasted the carnet de passage of each man furnished the bureau of evacuation by the bureau of admissions. This is given the commander of the train, who receipts for it and sends back the slips with the destination of each man entered thereon. Thus the completed record at last rests at the hospital. Patients carry their envelopes, with the field medical card of "billet de hospitalization" plus clinical notes, X-ray pictures, sketches, and recommendations for further treatment.

Patients are sent from the wards to the train shed an hour before train time. It takes about a half hour to load sitting patients on a train holding 150 to 200 patients and one hour and a half to load lying patients.

Other notes.—In this H. O. E. there are 800 beds for hospitalization alone, 800 for those to be evacuated sitting, 775 for recumbents, and 900 for éclopés. There is a fine ophthalmological center here, central sterilizing plant, and X-ray laboratory. Otherwise it is the same as H. O. E. 32, but not so well situated or kept up. A feature of this place is a group of 18 portable laundries.

H. O. E. AT TRAMERY

Also an H. O. E. of the third echelon, composed of 80 Bessonneau tents and 4 hangars. There are 3 operating groups in this hospital with 4 tables for serious and 2 for light cases each; 12 teams work in each group. We learned here that a Bessonneau hangar is set up only

by army constructing teams and that it takes them three days to do it. Bessonneau tents are set up in three hours. The Bessonneau tents hold from 15 to 20 patients, using iron bunks, or 30 litters. There are 42 evacuation wards and it was said that they can handle 1,200 surgical cases a day of 24 hours.

At this hospital we saw the best pharmacy and the best central sterilizing plant it has ever been our pleasure to inspect.

H. O. E. DE LA VEUVE

This is a large evacuation hospital of the second echelon, 18 km. from the front, with a capacity of about 3,000 patients.

There was a beautiful gas quarter, remarkably complete and permanent, in which on one occasion 600 were received and cared for in 8 hours. Here we were informed that for outer clothing impregnated with gas 10 minutes at 90° C. in an autoclave is sufficient if the pieces are aired for 3 hours thereafter. They can perform 120 major operations a day here. They also have one operating room set apart for septic cases.

The following is a statement sent me by le medecin principal de 2 classe Bechelonne, the 30th of May, 1918, just before the German offensive:

Capacity of the H. O. E.

Different services	Beds	Auxiliary beds with mattresses and blankets	Space on plank platform with mattresses and blankets	Seats in double benches with backs	Total
Hospitalization.....	617				617
Gassed.....	240				240
Evacuable recumbent.....	352				352
Evacuable sitting.....	190	360	510	510	1570
Total.....	1399	360	510	510	2779

The hospital can be divided into four sections:

- (1) Gas quarter composed of 3 Bessonneau tents, 2 Bessonneau hangars, and 4 barracks.
- (2) The section for the evacuable—(a) recumbent (4 barracks); (b) sitting (in 2 barracks, 2 Bessonneau hangars). In this subsection barracks 23 and 24 are used by the otorhinolaryngologist and barracks 28, 29, and 30 by the ophthalmologist.
- (3) The section for hospitalization (severe, intransportable wounded), found in barracks 2 to 15, inclusive, and the operating groups 1 and 16.
- (4) The section for the personnel barrack P. P. and T——. In addition there are storehouses, a tea house, a pharmacy, baths, douches, etc.

In Bessonneau hangar 42 is a reserve of medical supplies.

COMMENTS ON THE FRENCH H. O. E.

The recent practice of placing them in echelon is certainly a great advance over their previous habit of one large one in the immediate rear of fighting units and the still more recent provision of a mobile tent evacuation hospital, packed and ready to move forward should be the basis for our future plans.

The French are also quite consistent in separating them from depots, towns, and troops cantonments. In addition they place them boldly in the open and still provide against a savage enemy avion attack on defenseless wounded by revetting each barrack and providing at least splinter-proof dugouts.

The practice of washing up a patient before preparing his wound for operation in the preoperating room is worthy of emulation.

There is a general approval also of the central sterilizing plant separate from the over-worked operating groups.

The salvage of dressings is another hint to our own hospital administration.

One of the very excellent provisions of H. O. E. 32 was a quarter for prisoners of war. The American soldier is unduly excited shortly after his wound, and he thinks and acts like a plucky boy with a bloody nose. The sight of a boche is apt to throw him into a state of mind at variance with that peaceful tranquillity of mind and body which it is necessary to secure in the hospital in order not to use up the remaining resistance against shock upon which we count to tide him over. A man who has just lost his right arm can not rest peacefully in a bed alongside of the man who represents the force that crippled him for life. There are many other considerations that make quarters for prisoners of war a real necessity.

In brief, the French, as do the English, demonstrate their dominating desire to make the soldier in hospital happy and comfortable and their innate love of all that uplifts the man's spirit takes form and substance here. But their evacuation hospitals are too large, too immobile, and too much surgery that could be done at the rear is exacted of them.

THE AMERICAN EVACUATION HOSPITAL

No attempt will be made to describe a regulation equipment well known to all of our medical officers. It needs no argument to prove that the original evacuation hospital as provided by our Manual for the Medical Department is utterly inadequate not only for hospitalization and the surgery of this war, but for rudimentary comfort.

However inadequate this hospital equipment may be, it is mobile and, with the equipment presently to be described, will obviate the most serious defects of the evacuation hospitals of our Allies. A few notes may be made on such as have been seen in operation to date, especially those functioning in the recent drive of our First Army in the Verdun sector.

With few exceptions they were placed in intimate confusion with large military centers right at or near the main depot and railroad loading platforms for military supplies. This was beyond our control, as there was no time to seek isolated places and we had to take preexisting cantonments of the French.

There was a group of two hospitals at a main military advanced base where a representative of the general staff (himself a medical officer), a representative of the chief surgeon of the army (also a member of the general staff), a director of all evacuation hospitals in the army, and a director of all evacuation were centralized. This most excellent and practical scheme worked like a charm, especially the provision for a director of evacuation from the front to the evacuation hospital and loading for hospitals to the rear. This latter officer had pooled all evacuation hospital transportation and was accomplishing in a systematic manner as to leave divisions quite free to meet their local difficulties without detaching their precious transportation to make the long trip back to the railhead.

Evacuation Hospital 6 (Colonel Baker's hospital).—He stated that he believed an evacuation hospital should be prepared to hospitalize 10 per cent of all wounded passing through, which would provide about 400 beds per hospital of 1,000 capacity.

He has 6 men and 4 clerks in his admission barrack with a 12-hour shift; 5 constantly on duty. In addition there is a triage officer.

Mobile Hospital No. 39 (Lieutenant Colonel Flint).—This is functioning as an evacuation hospital of the first or second echelon. It was a model of good administration, clean and neat and scrupulous in providing comfort and amusement for the men. It had the inestimable advantage, however, of having remained fixed for a considerable time and of not having been driven from pillar to post. It had also been for this reason especially favored by supplies of all kinds.

His scheme of apportioning beds was noteworthy. Behind each of the operating pavilions he had a little room for 6 litter bearers and between the two a booth for a regulating officer of admission to wards (a sanitary officer or a sergeant). When the operation is completed, the surgeon designates the ward and calls the litter bearers, who carry the patient directly to it, receiving from the nurse a slip giving the man's name, organization, ward, and number of bed. This is taken to the regulating officer who card-indexes it and fills the ward bed on his ward diagram. Thus, at any time he can give the number of empty beds or inform anyone where such and such a patient is.

He also has an artist in his triage team who sketches the point of entrance and exit of the projectile. These sketches at the close of day are charted with the number of the case on a 6-foot figure of a man, front and rear view, seriatim. This forms a composite of all wounds of a determinate number of patients in series and is most valuable in determining the relative frequency of wounds of regions as well as giving a chart form from which histories of wounds of these regions may be looked up and made instantly available for scientific analysis. Otherwise one would have to wait until after the war to draw conclusions of vital importance for current treatment, comparison of method, etc.

The evacuation desk is provided with a sergeant in telephonic communication with the central office. Men are checked out here by telephone as they leave for their destination. They carry with them their field card, sketches, and a brief statement of the case. Here also are locked in a long box the man's valuables which have been collected from him on his arrival and are now returned to him on his departure. Every surgeon initials the history of each operation he performs and is thus made responsible for the operation.

This hospital takes only nonevacuable theoretically. It is a great credit to our corps.

American Red Cross Hospital No. 110 (Major Morehead).—This fortunate organization inherited a very complete and handsome French evacuation hospital, but while it had only been here three days, during which time it was receiving the wounded from the Verdun battle, it was as neat, clean, and orderly as though it had been here a year. This was particularly so of the gas quarter, which was very nearly perfect and installed in Bessonneaus. Its reputation for rapidly reaching a state of cleanliness and efficiency is made, as this hospital, thrown suddenly into a filthy little hamlet evacuated by the Germans near Coincy on the Marne battle field, was a model of cleanliness and comfort only a few days thereafter.

Its capacity is 1,100, and it is acting as an evacuation hospital. There is a tremendous danger from fire in Bessonneau huts, as Colonel Flint tells us that these tents are impregnated with paraffin and everybody is usually burned to death before they can get out in case of sudden fire.

COMMENTS ON THE AMERICAN EVACUATION HOSPITAL

Evacuation hospital ambulance companies.—In widely distributed evacuation hospitals each should have for a period of activity not less than four of these companies. No divisional units should ever be called on to send their patient back from field hospitals, especially in a war of movement. The ideal would be to replace every ambulance leaving the divisional area by another. This would prevent unnecessary hauling around of patients and might make possible a transfer direct from the ambulance head to the evacuation hospital.

Colonel Grissinger, corps surgeon, states that he believes that mobile hospitals (the so-called auto-chir's) should be used at the rate of two per corps and sent up for nontransportable to the battle field. Major Poole, M. C., insists that it is necessary in evacuating to evacuation hospitals for the director of these hospitals to keep the director of evacuation informed of the numerical state of each one, to the end that each hospital receive its equal share of wounded. They would be there so dealt out, as it were, that every evacuation hospital should be at the same time fed with cases to the point where each is six hours behind in its work. Then when a flood of wounded comes their wounded can be evacuated into anteoperating trains and moved to the interior.

The matter of relieving the strain on these surgical hospitals and evacuation hospitals is best met by insistence upon the sound principles enunciated by our own teachers, Colonel Munson and Colonel Straub particularly, with regard to the establishment of stations for slightly wounded. These stations can be manned by 1 officer, 1 sergeant, and 5 men, who would act as a dressing and forwarding party. The position of such a station should always be cited in the battle order and these wounded should be sent back in trucks furnished by the corps surgeon to a surgical field hospital in the rear on the railroad paralleling the battle front. According to Major Poole about 15 per cent of these slightly wounded, no matter how carefully culled, need X-ray localization and operation, and he calculates that 3 teams would clean up 300 in 24 hours, doing 50 operations. He also calls attention to the self-evident fact that very slightly wounded men do not need a hospital bed but could even be quartered around the town or cantonment, provided they were always under surgical surveillance. Colonel Grissinger also acceded to the proposition that slightly wounded should be cared for in a corps field hospital.

COMBAT EQUIPMENT OF AN EVACUATION HOSPITAL

Admission and operation, sitting cases: Bessonneau hangar, groupe complementaire de chirurgie (mobile surgical unit).

Admission and operation, recumbent cases: Bessonneau hangar (arranged for recumbent with stands for litters, holding 4), mobile hospital complete.

For hospitalization: Bessonneau tents (mobile hospital) as per equipment, Bessonneau tents, extra, 10.

For evacuation: Recumbent cases, Bessonneau tents, 10; sitting cases, Bessonneau tents, 20.

Gas quarter: Bessonneau hangar (triage, bath, treatment for mustard gas); Bessonneau tents, 10.

This would provide accommodations comfortably for 1,200 cases, expandible to 1,500.

One degassing outfit (which would also provide a bath).

Wall tents for officers.

Wall tents for nurses.

Pyramidal tents for men.

Old-style field hospital wards for dining rooms, 2.

Old-style field hospital ward for pack store.

Old-style field hospital ward for commissaries.

Old-style field hospital ward for medical and surgical supplies.

Hospital tent for kitchen hospitalization area.

Hospital tent for the evacuation area kitchen.

Hospital tent for nurses and officers' kitchen.

Hospital tent for replacement stores (to be sent back to divisions by returning ambulances in exchange for articles brought with patients).

Hospital tent for dispensary.

Hospital tent for pharmacy.

Hospital tent for linen.

Section de hygiene corporelle for bathing and delousing.

In time of inactivity and relative permanence the following dependencies are believed necessary:

Garden.

Portable laundries.

Chapel and morgue.

Guardhouse.

Baggage room.

Central sterilizing plant.

Laboratory (bacteriological).

Radiographic laboratory.

Theater.

Canteen.

Library and reading room.

Amusement hut.

Central office.

Electric plant.

Auto park.

Repair shop.

Electrical shop.

Carpenter shop.

Tailor shop.

Cobblers' shop.

Tinsmiths' shop.

THE ORGANIZATION OF A CONVALESCENT CAMP

By Maj. Alfred E. Cohn, M. C., senior consultant in general medicine, A. E. F.

The convalescent camp in the British and the American Armies is no longer a theory and a pious wish. It has become an indispensable institution. Whether for return to the line or to civil life, it performs a function which is relatively speaking new in medicine. But convalescent camps or hospitals, the name matters little, have for a long time been the hope and despair of physicians in civil practice, especially in great cities. The war has forced the solution of this, as it has of so many problems. Of the medical activities, it has become for the Army as important as any of its branches. As reckoned by numbers, its value is estimated not by thousands, or tens of thousands, but literally by hundreds of thousands. And it is not only the line which the convalescent camps will supply and benefit, it is also the Services of Supply.

What is the convalescent camp, and what are its purposes? In the first place the camp is not a hard-shell stereotype institution. It is an institution with a spirit. A powerful and inspiring personality must pervade its life, and the source from which the spirit flows is the commanding officer. The other officers who are his assistants must be imbued with it. Its direction is toward stimulating renewed endeavor, the will to do new things with which the camp should fire the imagination of its inhabitants. In no place should the spiritual and intellectual causes of the war receive more thorough and adequate treatment than here. To understand them is to want to contribute to victory.

The conditions of life in the American Army are so unusual in comparison with those in the Armies of France and Great Britain and of the Central Powers that new and possibly different facilities are required for it. It is more nearly like that of the Canadians, Australians, and New Zealanders. A separation of 3,000 miles renders the chance for the best kind of convalescence, that at home, impossible. The usual sources of cheerfulness are wanting; sympathetic interest in the individual is supplied as well as it may be in a thin and pale form by organized well-wishers. These are scarcely substitutes for the real contacts with live people which the home furnishes to which the British and French can go. It is idle to pretend that an adequate substitute for America can be found in France. But a substitute for it we must nevertheless try to provide; a spirit and method for the whole plan must be found. Unless the spirit is correct, a dull and soulless thing will result. Has it ever happened that a man has been made content with a form, when the form was divorced from the spirit? The men in charge of camps must supply the spirit; they themselves must be men of spirit. Such men have succeeded in making the British convalescent camp the success it is. The officers must be able to play on equal terms with their men at games and at the same time be leaders having the respect and confidence of the men—cheerful, resourceful, just, intelligent. If the leaders are worthy and have the strength, they will set the spirit for their camps. They will set the spirit anyway, for good or ill. No two leaders will be alike. Uniformity need not be expected of them. Uniformity would be in fact undesirable. Every stimulus to individual initiative that is possible should be given. The real fruits in this work will undoubtedly spring from originality; and originality should be recognized and rewarded.

Models are unquestionably useful. The British convalescent camp as a model is in point of fact wholly admirable. Undoubtedly it expresses thoroughly and adequately the spirit of the British nation. It breathes a sense of order, a love of form, and presents the marks of what in Great Britain is decent living. Its growing flowers, its games, its music are all peculiar to the British spirit. If another nation were to imitate it slavishly it might do an unprofitable thing. It would result in adopting the expression of a spirit it does not possess. In the American Army, no doubt much of the machinery useful to the Britisher will be adopted; undoubtedly its uses will be given a somewhat different turn, adapted to our needs. Can anyone say what these needs are? Does anyone really understand the requirements, the psychology of the American soldier under these conditions? Has anyone studied the matter so that use may be made of the study? The information which is required is not available. But we have certain tools we are able to bring to the hands of the workers in our camps. These we must leave there for each one to manipulate as his native genius will dictate. Confidence in the successful use of them is so strong within us that we may go on, assured that we shall find the proper use of the means at our disposal.

We expect and require certain results to flow from the convalescent camps. We expect to make men well. That is the duty of the medical officer. If our work is well done, we shall make soldiers fit for front-line service, and we shall recognize those who are not. This does not mean that men fit only for front-line service will result from the convalescent system. That is far from the truth. The Services of Supply will likewise benefit constantly from having supplied to it both unskilled men and men of high training. Many adapted to such service will be found.

In this sense the convalescent camp is in effect a sorting station. It is called upon to decide what service a man can render. It bases its judgment on what it has observed that a man is actually able to do. The method is different from the old hospital method. There, judgment of efficiency was a mere guess and was accompanied by the hope that the judgment might be correct.

The new method leaves little to chance. While the work of sorting the fit from the unfit is going on, the convalescent camp fulfills another important function. It attempts to elevate morale. How does the camp do these things? What means has it at its command?

Of the qualifications desirable in the commanding officer and his staff, a description has already been given. The general appearance of the camp is a matter of great importance. The camp should not be luxurious; but it should not be uncheerful. To obtain cheerfulness, the camp should be laid out not with wasteful, but with liberal, use of space. Crowding must be avoided. Color can be given to it and cheerfulness by generous use of growing flowering plants. In France success in gardening can be secured and a good show obtained in the first season.

The entire grounds should be attractively laid out and the planting suitably arranged. If barracks are available, the use of black and white paint is suggested, or substitutes for them. The attractiveness and cleanliness and tidiness of the place is much enhanced by the use of these simple devices. They are not unimportant things, as a matter of fact. The use of them adds immeasurably to the work of improving the mental background of the men. To bring this about is one of the chief things for which the camp exists, just because deterioration in mental background or morale is one of the principal ailments of the men. There is therefore excellent ground for laying emphasis on this aspect of the organization of the camps.

The camp is naturally an intermediate station between the hospital and the line. There must consequently obtain in it an approach to military discipline. The day should be occupied with drill and work and play, all supervised more or less rigidly by medical officers and non-commissioned officers. There must be entertainment as well. The men must not be permitted to be bored. To prevent this, occupation for the body and mind is required. These are the elements, work and play, with which the object of the camp is accomplished. They can be arranged and varied in endless variety. But the arrangement and variety must be left to the genius of the officers in charge. The means are slight and the successful working with means such as these depends largely on the spirit which animates the work.

But these means do not exhaust the possibilities. A great aid is music. Each camp requires at least one brass band; possibly other organized musical units are desirable. The band is especially useful in route marches; it diverts, it stimulates, it encourages. And then there ought to be connected with each camp the kitchen garden or farm. Experience must teach how many men can benefit by the use of the farm. But it will probably be found that an acre for one to five men, so employed, is required.

Trades must be provided for in the camp; a tailor shop is required and a barber shop and perhaps a shoemaker's shop as well. But aside from these shops, means for carrying on vocational training might well be instituted. Articles for use, not so much in the Army as in the hospitals, could be made. Whatever is made should be thoroughly useful. Men should not be permitted to get the impression that they are tinkering. It should be apparent that whatever they are making is seriously required. Men at war do not want to be played with. Manufacture should be confined to such articles as are, in the first place, indispensable and, in the second place, capable of being made in such quantities as can supply the need for them. Articles that can be made probably include splints, bedside tables and chairs, bedpan racks, hot-air cribs, dressing carts; printing, especially with moveable type, might be undertaken to supply the medical department with its various forms.

And, again, a large amount of work in caring for, developing, and enlarging the camp will constantly want to be done. As much of this work as possible should be done by the convalescents themselves. They will do it, not as fatigues, but because they will be stimulated by the desire of living in decent and reasonably attractive surroundings. Experience has shown that fatigues do not as a matter of fact constitute the most salubrious method of carrying on convalescence.

In addition to the equipment for the camp which has been suggested, a gymnasium and a partially protected shed for drill and exercise should be provided. The gymnasium should of course be equipped with apparatus and all necessary appliances. Both the exercise shed and the gymnasium must naturally be of requisite size.

The organization of the camp itself is a vexed question. The principle that men in camp are not sick is correct and is now established. The arrangement of the men in the camp is,

however, difficult. If men are admitted into the camps directly from base hospitals they will be found in all stages of convalescence in the camps, some having been out of hospital for rather a long period, possibly three weeks; others having recently come. The two classes naturally can not be managed as belonging to the same class. In practice, the difficulty can be obviated in one of two ways.

In the first place, men can be divided on admission to the convalescent camp into three classes, according to their physical ability. In the first class the amount of exertion required is limited and small; the second is an intermediate class; and in the third class the amount of exertion expected is equivalent to the maximum required in the line. A soldier is advanced to a higher class as soon as his abilities, in the judgment of the medical officer in charge, permits; he will be discharged from camp as soon as he is capable of doing the amount of work required in the line.

The convalescent camp, on the other hand, might be arranged so that preparation is made for one class only, all convalescents being managed in a single group. If this were done, the work of sorting and the bringing of men to a single standard of fitness must elsewhere be provided for.

This work could be undertaken either by the intermediate camp or the base hospital. If intermediate camp were provided, patients would proceed to the convalescent camp only for stage three of their training. This alternative has been adopted by the British in the Rouen district. The intermediate camp acts as a clearing station for patients discharged from base hospitals, for sorting into classes sent before medical boards or sent to convalescent camps. Those who are detained in this camp are of the skin cases and the D. A. H. cases (effort syndrome cases in the American Expeditionary Forces). The care of the latter cases is especially important.

The same preliminary work would be required if work of grading and initial stages of exercise were carried on in the base hospitals. In this case it would no doubt be advisable, as the chief surgeon has recommended, to detail officers to see to the sorting and training. A certain portion of the hospital would then be set apart for this purpose, as much of it, indeed, as the service requires for carrying on this work. In this case, one medical officer with assistants, if necessary, and properly trained noncommissioned officers would devote their time to this department. In any case it must be pointed out that there can be no escape from graduated retraining, whether in the convalescent camp itself, in the base hospital, or in the intermediate camp. Convalescents can not profitably be regarded as all equally able physically.

The question of the amount of medical attendance required is a matter of open discussion. Provisions for illness must no doubt be made. In the single class convalescent camp it has been found that 11.7 per cent of cases return to hospital. At one of the camps in England (Eastbourne), 4 per cent of the beds were kept in the camp itself as sick beds, quite apart from the fact that the seriously ill are sent to near-by hospitals. But medical officers are needed in addition, in order that judgment may be available as to whether fitness for duty has been attained. The making of such decisions is not a simple matter. Medical officers especially trained for this work should therefore be provided in such numbers as are necessary.

What variety of disease or disability should be sent to the convalescent camps? Men ill of certain diseases, especially, have been found to benefit from such treatment. These include trench fever, pneumonia, gas poisoning, rheumatism, effort syndrome. Only those diseases of interest to the medical sections are enumerated here. The section of neuropsychiatry has found it advantageous for certain of its cases to manage their convalescence independently. However, the surgical sections very likely will want patients for whom they are responsible to benefit by the advantages to be gained from the camps.

The convalescent camps are, then, for America, new institutions. They bridge over for patients that often mismanaged interval between illness in hospital and restoration to health. The special circumstances which attend the conditions of the war have made it necessary to consider, in addition, other aspects of convalescence more closely associated with the psychology of the sick. These subjects have been discussed in this paper. The attempt has likewise been made to point out how the purposes of the camps can be furthered, both from the point of view of the kind of personnel likely to be most serviceable and from that of the

organization of the camp itself. At the present time there is little doubt that the spirit which is infused into the life of the camp is the first essential, and for this spirit the commanding officer will be responsible.

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THE APPLICATORY METHOD OF TACTICAL INSTRUCTION

By Col. P. S. Bond, C. E.

There is no form of human endeavor where more skill, intelligence, application, and care are required than in the military art. In spite of this fact, it is a rather curious thing that a great many people imagine that after coming into the Army one never has to use his head or think because everything is already thought out and provided for in the regulations. I am quite satisfied that a large proportion of our soldiers have the idea that everything is governed by orders and regulations which relieve one of the necessity of thinking. That is as wide of the truth as it could be. The regulations do indeed serve a purpose and it is this: That in the large body we have to control they aim to secure a certain minimum of service from everyone. They certainly were never intended to hold back a man able to do more than the minimum. It is well to bear this in mind in interpreting the regulations. If your motives are pure and you are producing results, you need have no fear of the regulations. They are intended to help and not to hamper you.

The elements of a military situation are exceedingly complex, numerous, and uncertain, and they are, moreover, all of them, subject to kaleidoscopic changes sometimes without any previous warning; and man, the principal element with which we have to deal, is unquestionably the most complex and difficult of all. You gentlemen deal with the physical nature of man and you have probably found that very complex. His psychological nature is yet more complex, and that is the one we have to deal with in war.

In science we proceed logically from one proven fact to another, but in war we have to make a pretty good guess and discount the chances of failure; and the difference between the difficulty of scientific investigation and of tactical investigation is indicated by the fact that history records many great scientists but only one really great commander.

The mistakes of a commander in war are rather expensive; they are paid for usually in blood. No matter how great a man's native intelligence, it must be trained in this profession the same as in others. War is a profession, and we have found that all great commanders were deep students of their profession. Napoleon was a great student of the military profession.

The position of the inexperienced man in the face of an unfamiliar military situation is nothing short of pitiful, and it is by training and practice only that his embarrassment and helplessness are overcome. I saw many examples of this in the National Guard before the war. I have seen officers who in civil life were aggressive and successful business men, yet when confronted with the simplest tactical situation were perfectly helpless so far as giving orders was concerned. Of course, I am referring to tactical situations as distinguished from drill, which they understood.

The highest degree of character, initiative, judgment, and courage are necessary to meet a situation where the lives of other men depend on your decision—not only the lives of other men but the honor of your country, perhaps. These traits are best developed by placing responsibility upon the shoulders of a man. That is true not only in our profession but in every other one, as you know. The knowledge that he has responsibility resting upon him strengthens a man who previously has been weak. So our problem is to find some means of putting responsibility on the shoulders of the officers, and I wish to give you to-day an outline of the methods that have been developed for accomplishing this purpose.

The system of instruction that has been developed is just as applicable to your branch as it is to every other branch of the service. You have the same situations to meet, the technique is different, but the fundamental principles are the same. You will sympathize more with the efforts of your instructors if you understand the methods that are followed, how these methods have been developed from crude beginnings up to their present state of efficiency, what they aim to teach and why.

In a practical profession it is necessary to have practical experience and training—and war is intensely practical. In civil life when a man wishes to follow a practical profession he enters that profession, starts at the bottom, and follows the practice through to the end and sees it under all conditions. Take, for example, your own profession. I do not suppose you have learned it from books alone. No one would care to trust himself to a surgeon who had derived all his knowledge from books. This is quite as true in war as it is in surgery. You can not learn surgery from books alone; nor can you learn war from books alone—you must have experience.

When a surgical operation is to be performed all the usual conditions are present. But in training for war, in tactical training, we must simulate our conditions, and we have found this a very difficult matter. In a technical way we have been able to simulate conditions, such as artillery and rifle fire. But the most important condition in war is an enemy opposite us filled with a desire and equipped with means to kill us, and we have found it extraordinarily difficult to provide a safe and satisfactory substitute for that enemy in time of peace. One attempt was the "sham battle," which was in vogue as late as when I was a cadet. Its name is a sufficient commentary upon it. There was one European government, I think it was Russia, which attempted to give a touch of realism to the sham battle. It was announced that 1 ball cartridge would be issued in each 1,000 blank cartridges, the idea being that each soldier would believe he was opposite that thousandth cartridge and this would induce him to take the cover of the ground and otherwise act naturally, the same as if an enemy were really shooting at him. The idea was not a bad one.

The most usual form of outdoor practical instruction is what is called maneuvers. It means the exercise of a body of troops—not drill, but tactical exercises carried out on the ground. These vary in size from the exercises of a company to those of a division or army corps, and they may be one or two sided; that is, one force or two forces, acting as belligerents. But there are difficulties with maneuvers. One is finding sufficient ground available within a reasonable distance of the stations of the troops, another is the difficulty of assembling troops, who often must come from a great distance. The cost is considerable, the amount of time lost very great. There are property restrictions and damages to interfere. If we cut a barbed-wire fence we find it was made of gold. The weather interferes very much. So that if maneuvers can be had for as much as one month in two years this is doing very well in the face of so many difficulties. The men do not take the matter seriously in time of peace. Nevertheless, maneuvers on both large and small scales were excellent forms of instructions, but on account of their limited application we found it necessary to employ other kinds of indoor training.

An officer is supposed to study his profession, to read military history, and follow the battles of the great commanders—and some do. But, as in surgery, study alone is monotonous and insufficient and a good many officers do not study if left to themselves. And then, too, the study of history and tactics alone did not develop those traits of character, initiative, judgment, and decision of which I have spoken.

When a man reads a book on the subject of the art of war the responsibility for the facts stated and the conclusions drawn rests upon the author; the officer who reads it obtains a certain amount of knowledge, but he certainly assumes no responsibility and thus loses the most important feature of training. It became necessary, therefore, to find some system that would cause officers to use their wits and make decisions; we needed a peacetime substitute for the actual conditions of war. The first effort to provide anything of this kind was in the form of games, and some of our old games are of military origin or were used for military instruction. Chief amongst these was the game of chess. Now chess certainly does make a man think and estimate situations, but at the same time a chess board doesn't look much like a modern battle field. The games, of course, were played according to arbitrary rules and bore very little resemblance to the warfare of their own day; certainly none at all to the warfare of the present.

When maps had been developed to such perfection that they actually represented the ground and presented a picture of the terrain to those who understood how to read them, it was found that a map was a very much better board on which to play out military games than the chess and checkerboards. And so the development of maps marked the dawn of

intelligent tactical instruction. For the arbitrary rules were substituted certain imaginary tactical situations, and this was a great advance on what we had before; and finally the applicatory system of instruction was developed, and even before this war it had come into vogue in the armies of all countries.

In this system the student is furnished with a map which is a correct picture of the terrain, provided he knows how to read it. He is then given a tactical situation; he is told that a certain body of troops are at such and such a place in certain circumstances and that they have been ordered to accomplish certain things. With these data the student proceeds to study the situation and come to a decision as to what he is going to do with the imaginary troops of which he is the commander. Having done this, he is required to prepare the plans and write the orders for his imaginary subordinates. There are a number of variations of this system, each one supplementing the other and varying the interest somewhat, some bringing out points that others do not bring out. One form is called the "map problem," which is a solitaire game. The student works alone with his map. He is given his data, he estimates the situation, comes to a decision, prepares his orders, writes it all out, and hands his solution to the instructor. He works all alone, the responsibility is entirely on him; he does not receive even moral support from anybody else. Another form of this instruction is the war game or map maneuver. It was the first form that was developed, and is a true game played on a rather large map, drawn to scale. The players are divided into two sides representing the two belligerents—very much as the boys play baseball. The leaders are selected by the instructor, and they in turn choose their men. Each side is then given a situation. Instead of writing out their orders, they confer amongst themselves, make their preliminary decision, and pin it out on the map. They are then sent out of the room. The other side is called in and carries the game to a certain point, stating their moves, after which they in turn retire; the other side comes in and carries the game to the next stage. In the interval the pins are removed, unless there are two maps in separate rooms, one for each side, because, of course, one side must not be allowed to know the disposition of the troops of the other prior to the time when in the natural course of events the other side would find this out for themselves. This is playing according to common sense. One commander says, "I would send an airplane." "Where would you send it?" asks the instructor or umpire. "To such and such a place." An airplane at that place would see certain hostile dispositions. The umpire says "Your airplane reports so and so. What are you going to do?" This is stimulating and considerably less of a strain on the mind than the game of solitaire. One does not feel so utterly alone when playing the war game.

In order to give the touch of nature, we have also outdoor games. One of them is called the tactical ride or walk. The instructor rides out with his students and gives them an assumed "situation." "What would you do in such a case, Captain Jones?" "Now, Captain Smith, what criticism have you to make of Captain Jones's decision?" and so on. There is also the terrain exercise. This is the same as the map problem except that it is solved outdoors on the terrain instead of indoors on a map. Terrain exercises are limited to small forces. It is impracticable to solve a problem with any considerable force (larger than a battalion) on the ground because of the impossibility of seeing and comprehending a large area. Therefore, even in actual operations, the problems of large forces are virtually map problems, or at least solved with the aid of a map. We have also one or two sided maneuvers, as I have explained before.

You will observe that the important feature of all these forms of instruction is that the student is compelled to make a decision. That is the vital feature of them all. He is required to make an independent decision; he is not allowed to ask somebody else what to do; he must come to his own conclusions from the information furnished him.

When the student has completed his solution, or when the war game is over, the instructor reviews the situation, calls attention to errors that have been made, and impresses them upon the mind of the student. Now it is a fact that to play games like this and to be shown your mistakes (and to acknowledge them) has to some extent the effect of practical experience. The game impresses itself upon the student's mind somewhat as an actual experience; not as strongly as actual experience in the field, of course, but certainly much more strongly than the reading of a problem which somebody else has solved, for in the latter case the student

reads but does not think. Another advantage is that the experience is cheap; it is cheap for the student, and cheap for the soldiers who might have lost their lives through his mistakes. The student must candidly acknowledge his mistakes and resolve not to make the same mistakes again.

This form of instruction simulates actual conditions very much better than the formal games and is a considerable advance over them. It is the best form of tactical instruction ever devised except the actual experience of warfare. It was developed to a state of high perfection even before the war. We had some difficulties in the way of creating plausible situations. It used to be the custom for students to take the situation presented by the instructor and pick flaws in it, pointing out where the situation was not realistic. These situations were based on the experiences of former wars. The latest war of any importance prior to this one was the Russo-Japanese War, and so prior to this war our situations for problems were based on the situations of that war. But as we progressed weapons were improved and new weapons invented, new conditions arose, and during peace, when there is no chance to see any real situations, it is difficult to keep up to date or predict what the course of the next war may be. However, this is only a detail, because, as you have been informed a number of times, the fundamental principles of war, like the fundamental traits of human character, are not subject to progressive change, it is only the manner of application that changes. Therefore the methods that we followed developed the judgment and power of decision of the officer, even if the situations were sometimes a bit forced; and through the application of this method we have been able to build up efficient armies even in time of peace.

I might say that, speaking strictly from our professional and not from a humanitarian point of view, we should look with enthusiasm to the next great war. We have developed the interesting warfare of to-day from a state of crude combat with clubs; we have made it a highly refined and delicate, if excruciating, art. In the next war we will start right, from the beginning, and it will be a wonderful fight.

All of our knowledge of war is, of course, based on practical experience, but this practical experience does not suffice for the individual. It is too costly; we can not afford to let him learn his duties at the cost of the lives of men. One man actually sees very little of the war, and the little that he does see is apt to give him false ideas and a one-sided development. I have seen many examples of this in the French, British, and American Armies. I could tell you many instances of it, but I will mention only one. I came across a British machine-gun officer somewhere in France. The approved method of machine-gun defense, as you probably know, is by the development of enfiladed fire at short ranges. Now this officer had a field of fire of about 3,000 yards, and he said to me, "This planning business is all tommyrot. What's the use of waiting until the enemy gets up to 50 yards when you can shoot hell out of him at 2,000 yards?" I said, "What would you do if he started at 100 yards from you; what would you do if he laid down a smoke barrage, or came on you in a fog or at night?" He said he would shoot anyway. He had a one-sided idea; he had never seen a situation where the lines were close together, he based his ideas on his own limited experience, and the result was dangerous. Even Napoleon, who knew more about the art of war than any other man, made the statement that no one man's experience could be trusted, but that the collaboration of other men was not only valuable but necessary. We can draw a problem in such a way as to bring out and illustrate quite a number of tactical points, and it is possible to give instructions over a very wide field. So we find that this system is still applicable in war, still useful, and in fact better now than it was in peace time, because for imaginary situations are substituted real situations based on experiences of the present war. Instead of guessing what the situations might be, we know what they actually are. We can show you things that you probably never could learn from your own limited practical experience.

Now as to the details of this method of instruction. We first have what we call the "general situation." For example, the United States and Germany are at war, the line of battle is at such and such a locality and the circumstances are these. Then follows the "special situation," presenting in some detail the situation of a particular command. This situation will include a deal of testimony or "intelligence," and from that testimony you are supposed first to determine the truth. Some of the testimony will be conflicting, some will be unreliable, some positively false. You are supposed to weigh the evidence and, like a judge,

determine the truth from this mass of conflicting and contradictory evidence—the “fog of war.” The requirements of the problem are that you assume the military situation, come to a decision as to what you are going to do, and prepare your plans and orders.

Decisions on military situations are not the result of inspiration; they can result only from hard and painstaking labor. There may be exceptions, possibly there are some commanders who act by intuition, who jump to their conclusions; but Napoleon said he never did, and if he could not I do not think it is safe for any lesser intellect to attempt it. For the average man we may take it as quite certain that he must study the situation and examine all the evidence before coming to a decision. There is no short cut, and it is lazy and criminal to make a decision on which the lives of men depend without thoroughly examining the evidence. You must learn to do that here in your course of study, because if you acquire the lazy man’s habit of taking the short cuts to decisions, you will not lose that habit when you are in the field, but men will lose their lives because of your habit.

The estimate of a situation is no innovation; it is something that we do in every walk of life, military or otherwise. When you are confronted with any situation you think over the conditions that bear on the situation, you examine the different courses open to you, and come to a decision as to which is the best of those courses. This estimating a military situation is nothing more than that; it is exactly the same as in the affairs of everyday life, except that we go into it a little more systematically, a little more thoroughly; it is an application of common sense to war.

I will read something on this mental process written by a German officer—I am sorry to present anything from German sources, but this was written before the war, and it does give a good idea of the mental processes of the estimate. He says, first, that you must read over the problem very carefully several times:

After we have gained in the above manner a correct insight into the details of the problem, we get to the main task, which is to think ourselves completely into the spirit of the problem and to arrive at an estimate and decision for our future course.

By repeatedly and quietly reading the problem, paying due regard to the map in front of us, we gain, just as in focussing a telescope, a clearer and clearer conception of the situation. The more we succeed in placing ourselves mentally in the given situation and recognizing all the details in their relation to the general problem, the more we succeed in thinking ourselves into the soul of the leader, in conceiving the magnitude of his task—and in sharing his responsibility, the more eager we shall become to take over his duties and play an active part in the operations.

The longer we pore over the map, the clearer will be our conception of the measures which the situation demands. And in this it is important to hold and consider carefully; that is, to follow out to their furthest effects, all the thoughts and ideas which come to us, often passing like lightning through our brains, and suggesting various lines of action. Often it is precisely these fleeting thoughts which lead us to the right path. But ideas which are not fully thought out and thoroughly weighed can not have a decisive influence on our judgment and decision. A head which has a hundred thoughts, but which can neither hold fast nor think out a single one, will always remain undecided and irresolute in tactics.

Only by intensive reflection is found in the confusion the Ariadne thread which will lead us from the maze. However, although attention to details is to be recommended, yet the larger points of view which we have gained must not be lost in the consideration of minor details—a mistake often made and naturally often leading to false conclusions. It is rather our chief duty to find just these main points, and attention to minor details is but a means to this end.

Character and intuition unconsciously weave their thread into this labor of comprehension. To that which our mind devises is added, with good or bad effects, that which our intuition presents; and from the combined activity of both come as a product judgment and decision.

It is a delicate psychological process which takes place in the head and breast of the tactician, and without doubt this inner effort is one of the most stimulating and interesting of activities.

A tactical question awakens all our spiritual and mental powers. It demands keenness and understanding, common sense and imagination, firmness and patience, caution and daring, sense of locality and memory, judgment and the power of decision. The whole character, the whole disposition, the whole individuality of a man finds its expression here. Thus the solution of a tactical problem reflects the spirit of its author, since it is based on the peculiarities of his own individual character. A hesitating character will, in doubtful cases, prefer the defensive to the offensive. Kindred natures will follow similar trains of thought and in the majority of cases reach similar solutions.

That, I think, is a very good presentation of the nature of these mental processes.

The first item that we take up in making this estimate is your own mission, because that is the basis of your subsequent thought. What do you want to do? What do you seek to accomplish? This might appear to be very simple, but it is not always so. Your mission may be directly stated in the orders you have received. On the other hand, it may have to be deduced from these orders and it may require considerable skill to make the deductions. Often you find that the situation has quite changed since the orders were issued, and with it your mission. You must have the sense and the spirit and the judgment to see what your mission is, and that is not always so simple as you may imagine. In making this estimate it is well to have a form—not to be slavishly followed but to insure that no important points be overlooked. There are many different forms for different classes of problems, and the man who solves problems usually devises some form of his own. Here is one merely to exemplify the idea.

1. The mission, of which I have just spoken.
2. The resources at your disposal. Do you need any more? If so, where are you going to get them.
3. The tactical plan on which your plan will be based.
4. The general conditions. Roads available, shelter, enemy fire, nature of the terrain, and how it affects your problems.
5. Eventualities. What emergencies may arise and how do they affect your plan.
6. The various courses open. There will be a number of such courses which suggest themselves, some of them radically different.
7. Comparison of these courses and weighing the advantages and disadvantages of each.
8. Decision on the best course to follow. Does it best meet the probable course of events? Is it sufficiently elastic to cover the contingencies almost certain to arise?
9. A plan based on this decision and, finally,
10. The orders necessary to translate this plan into action.

A few general suggestions on the preparation of estimates, plans, and orders may be of some help. They are mostly of a practical nature. One of the first, however, is that you must be able to read a map. Colonel Ashford told you that yesterday, and I wish to add my testimony to his. The modern war game is played on a map; for all commanders it is a map problem, and if you can not read a map you will be almost helpless when you are confronted by a military situation; the map is absolutely indispensable. You must also know your matériel, its nature, capacity, and limitations, including transportation.

You must avoid dispersion; don't scatter your forces all over the terrain. This does not mean you can not distribute them, but do not scatter them so that they can not be assembled when needed to meet emergencies. This depends on liaison to a very great extent. The importance of liaison can not be overstated. The course of events in warfare requires constant attention by the commander, and the only way to do this is to have a perfect system of liaison. Find out the systems of liaison available and use them to the utmost, and as a last resort have some good trusted runners. You will undoubtedly have need of them.

Simplicity is the keynote of sound tactical procedure and should characterize all decisions, plans, and orders. In the stress of combat only the simplest plan has a chance of success. A complicated plan is poor tactics and is extremely dangerous in war.

The nature of the terrain may be of vital importance. Fortunately the terrain is not subject to change, but the roads may be blocked, bridges or culverts destroyed by enemy fire, congested by other traffic. Times and distances are matters of vital importance. You might think these very simple matters, yet we have known time after time cases where a student solving a map problem would assume that he could reach such a place at such an hour, when if he had taken the trouble to measure the distances and calculate the times he would have seen that he could not arrive there in twice the time or that the enemy would certainly reach the locality first. Times and distances are likely to be matters of vital importance—make no mistake about them.

Do not spend too much time on unimportant matters, except to satisfy yourself that they are unimportant. Your form will probably cover a great many of these, in fact it should, but you must acquire what we call a "sense of proportion." It is the ability to distinguish the things that count from those that do not.

Learn to do your work fast, but not hastily; learn to travel the right road at high speed, but do not take the short cut. Don't pile one contingency on top of another; the pile will be very unstable. Don't jump violently from one idea to another or allow each new conception that enters your mind to upset all your previous ideas. That is one of the characteristics of the untrained mind, the irresoluteness that allows it to be thrown completely out of gear by each new idea that enters.

Jot down each idea that enters your mind, think out each one to its logical conclusion, and then take up the next one.

You should go over the situation several times on the map. Each time it will be clearer. The first time over there may be five or six points you do not understand; the next time over two or three of these vague points will have disappeared. On the third reading the situation will be perfectly clear. And each time you read over your problem you discover something you have overlooked in former readings. I will not try to explain the psychology of this. I tell you only that it is true.

Do not seek too long for the absolutely ideal. A good plan, promptly prepared and vigorously carried out, is better than the best plan too long delayed and not vigorously executed.

As a result of your study you will find a number of methods by which you might accomplish your mission; perhaps there will be one or two, perhaps there will be seven or eight. Usually the more skillful you are the fewer and better will be the plans you evolve. You must select the best of these courses, and you should first arrange them in groups according to similarity if there are many. One group contemplates one general method, another group quite a different method. You consider the groups as a whole and perhaps discard an entire group. This saves time. You finally select the best group and from this the single plan that appears to be the best, or you may perhaps combine the best features of two or three. But do not try to straddle every situation; you must come to a clean-cut decision; you must decide between two different courses, but do not straddle them. I remember a situation in a problem given out at Leavenworth: A student, whose solution I read, was not quite sure what he wanted to do. The first time I read his problem I thought he intended to attack, but it was not perfectly clear. I read it over again. The second time it appeared to me that he intended to take up a defensive position. I read it a third time. "No; he is going to take up a position in readiness—for advance or retreat." I read the problem a last time. "I have it now; what he intends is to retreat." This was a case where the student had been unable to come to a decision. He was lost in a maze of possibilities and he attempted to straddle them all.

It is quite manifest that these are not problems in arithmetic. Similar minds will reach similar but never identical solutions. The fact that two solutions are different does not prove necessarily that one of them is wrong. Either of them might accomplish the results if vigorously carried out. But do not get the idea that any solution will do. There is always more than one solution, even more than one good solution.

For a beginner at least it is a good thing to write out the estimate of the situation. A lead pencil seems to stimulate the mental processes, and we have made it a rule to always require students to write out their estimates. You need not write for publication, but you should write out or at least jot down notes of your ideas, because if you don't put them down they will escape you; you must pin them down. This, moreover, gives you the best form of practice, and practice is the only means of becoming perfect or of approaching perfection in tactics, the same as in surgery or any other practical art.

As a basis for estimate and decision, you must be acquainted with what we call "good practice." There are certain people in every profession who make great discoveries and thus we have progress in science. But the average practitioner should seek to learn good practice, to become acquainted with the methods of the great surgeons or great engineers; and being fully acquainted with that practice, with which he keeps in touch by reading, observation, study, he can apply it to the situations which he meets himself. This is the case in war. One must know the methods by which efficient commanders accomplish their results and apply them to one's own problems.

You must learn to work against time. You have always a certain limited time to meet situations, and you must learn to make the best use of that time. That is something the beginner finds it hard to appreciate, and he will spend hours of his time going over some matters of no vital importance and will have no time left for matters that really do count.

Don't fail to be thorough in your work and don't trust to luck to bring you out right. It may be that the Lord occasionally saves the fool from his folly, but as a rule He helps only those who help themselves. When you have made a thorough and careful estimate of the situation, and only then, you are able to make an intelligent decision.

When your decision is made have the courage to carry it out unflinchingly. Do not let doubts begin to assail your mind the minute you make your decision. Your plan may not be perfect, but if you carry it out vigorously and forcefully you will succeed, and if you vacillate and retract you commit the gravest of military crimes and you invite disaster.

Having made the decision, you will prepare the details of the plan of action which are based on this decision, whereupon you reach the very critical stage in which you are called upon to prepare orders for your subordinates. Your decision, however wise, is useless, perfectly useless, unless you can translate it into action through the medium of good orders. Having cleared Seylla, be careful that you do not wreck the enterprise on Charybdis. So I want to give you a few suggestions in regard to orders. The first one is: Don't attempt to write an order until you are perfectly sure what you want. Your orders will reflect your state of mind. If you are not sure what you want, you certainly can not make it plain to your subordinates. You can only communicate your indecision to them.

The orders should be expressed in professional language. I believe you, being professional men, will sympathize with this. Every profession has its language, and when we talk with our professional confreres we like to have them use that language. When you are talking with a man who professes to be a surgeon you can soon tell from the language he uses whether he is really a surgeon or not. If he does not speak your language you know he doesn't belong to the profession. The military profession has its language. We use certain terms and certain modes of expression, and your subordinates will be used to this language. If you do not use it they will think you do not know the game, and probably they will be right. As a consequence they will lose confidence in you, if, indeed, they ever had any. You must learn the language and use it.

Orders, to be easily translated and readily grasped, should also be according to form. For your tactical orders we have a very excellent form and we stick closely to it. In administrative orders, such as you will have to give, there will be more elasticity, but at the same time you should have forms for your orders, and these forms you will learn here. Use them, because if you do not you acquire the habit of giving orders in a haphazard way. Those who obey the orders learn to look for certain matters in certain paragraphs. If they do not find them in the usual place they may not look farther, and the orders are not carried out. The form and arrangement should be professional and characteristic, like the language. If you do not use a systematic form your subordinates will again lose confidence in you.

Orders should be brief and should contain no unnecessary words. Brevity is the soul of wit and the soul of tactical orders. These orders should above all be clear; but you will generally find that brevity and clearness go hand in hand. Learn to express yourself in brief, simple language. This is a characteristic of military parlance. Long orders indicate laziness. It is harder to read a long order than a short one. A long order arouses hostility on the part of your subordinates. If any of you has ever belonged to a division, as no doubt you have, and has seen the amount of literature that comes from that infernal machine called a mimeograph you can sympathize with those who are the victims of over-many orders, especially when they never know the people from whom these orders come. They live in the infernal regions and simply grind out orders.

There should be only so much detail in an order as is necessary to secure results. It requires a good deal of skill to determine just what that should be. The amount of information, as distinguished from instructions, that is contained in an order, should be just sufficient to enable an intelligent subordinate to understand the situation and the mission. This is necessary so that in case he meets an emergency unforeseen in the order he will be

able to act intelligently and do what you would have him do—in other words, carry out the spirit of the order. He can not do that unless he knows the situation, and unless you have made it clear to him what you are trying to accomplish. The amount of detail that should be included is largely dependent on the training and efficiency of your subordinates. In our map problems we make the assumption that each subordinate knows his duty and is fully competent in his own sphere, but, of course, in actual practice this may not be the case. You may have green, untrained men, and it may be necessary to give them more detailed instructions than would be necessary with highly trained men who understand their work. If there is time and opportunity, you may assemble your subordinates and discuss with them certain matters which it would not be proper to include in an order, and make perfectly sure that they understand what is wanted. But there will not always be an opportunity to do this.

Reasons, conjectures, arguments, discussions, guesses, have no place in an order. Don't argue—command. That's what orders are for. Ambiguity, of course, is a fatal mistake. It nearly always results from a lack of decision. If you don't know what you want, of course your orders will be ambiguous.

The orders must agree with the decision and you must check them and see that they cover every essential point and insure performance of what you want done.

In a combined order for the entire command you should see that you have given every one of your subordinates his task and that you have covered the disposition of every item of your equipment. You should make lists of your personnel, or of all who are to receive orders. If you are not to give orders direct to certain men, make sure that they are under the control of other men to whom you do give orders, and that both parties know it.

Written orders are preferable, but if obliged to give a verbal order use the same language and the same general form, and don't speak until you have decided what to say. It is a common fault to speak without just deciding what to say, and it always produces confusion. Your subordinates will perceive at once your state of indecision, which is communicated to them. Make notes of what you intend to say, and unless it is very simple cause your subordinates also to make notes.

Do not invade the province of your subordinates by detailed instructions as to how they are to perform their duties. Tell them what to do, but not how to do it. If you put no responsibility on them they will feel none, and the man without responsibility has nothing to hold him steady in a storm. If you are satisfied a subordinate does not know his task, it is better to send him to Blois and put in somebody that does. If the men are new and green you have to teach them, of course. They can not be competent in the beginning. Train them.

Do not divide responsibility with your subordinates or "pass the buck" to them. Avoid such expressions as "If possible," "If you think best," "If conditions warrant." Shoulder your own responsibility and put your subordinate's strictly up to him. If he has to carry your responsibility you are plainly superfluous, and might better be disposed of yourself, and, on the other hand, if you give your subordinate no responsibility he will take none, and it is the feeling of responsibility above all else that compels us to do our duties.

Do not discuss contingencies in an order or look too far ahead. It isn't safe in war. Conditions are very unstable, very subject to change. War resembles a kaleidoscope; you can not predict what is going to happen too far ahead. You must have the future in mind yourself; be prepared, but do not include plans looking into the far-distant future in your orders. Let the situation develop; it will then be clearer and you can give intelligent orders at the right time. If your orders dip too deep into the future you run a tremendous risk of having to retract them, thus destroying the confidence of your subordinates in the commander who has too plainly guessed and guessed wrong.

If you have seen fit to omit from your orders certain items which are usually included and which your subordinates expect to see, it will be well to explain that orders on these matters will be given later when occasion demands. This shows you have not overlooked or neglected some important point and relieves the minds of your subordinates.

There is only one method of becoming perfect in order writing, and that is practice—practice. So make the most of what practice you will be given here. If you acquire a habit of laziness at the start, you will probably continue that habit in the field.

The elements of success in war are simple plans, based on good judgment, and painstaking study, and carried out with unwavering determination. Do not allow apparent emergencies arriving after the promulgation of your orders to stampede you into a violent disruption of your carefully prepared plans. This will produce more confusion than the emergency you seek to evade.

These data I have been giving you are applicable of course to larger problems, but they are equally applicable to the smaller ones. There is no decision you make that is too small to be worth your care and attention. Be honest in all you do. Make prompt decisions but never snap decisions. It is not the length of time required for the solution that determines the importance of the problem. An important decision may be made in an hour, or in five minutes. Do not think that because a decision must be made promptly you are relieved of the necessity of using your wits and giving it careful study. All these precautions apply to the little matters just the same as to the big ones, and, as you know, the big ones are made up of little matters after all.

As our forefathers said, "We hold these truths to be self-evident and fundamental." I make no apologies for my subject, for its importance can not be overrated. I only hope I have been able to present it in such a manner as to convince you and to stimulate your interest in the excellent course of instruction you will receive at this school.

Army Sanitary School No. 153.

PLAN FOR EVACUATION OF SICK AND WOUNDED

By Col. J. W. Grissinger, M. C., chief surgeon, First Corps

REGIMENTAL SERVICE

1. *Battalion aid posts.*—Battalion aid posts and relays of litter bearers, when the latter are necessary, will be established at such times and places as may be determined by regimental surgeons under the supervision of the division surgeon.

It will be the duty of the regimental sanitary personnel, and the attached litter bearers detailed from line troops to apply first aid, including splints when needed, to the wounded as they find them. They will then litter them to the battalion aid post, which is simply a collecting point for wounded. One of these collecting points for a regiment will frequently be all that is necessary. It should, if possible, be placed in a sheltered spot.

The regimental litter bearers must pass no farther to the rear, but must return at once to their organization in the line and continue their search for wounded. They must not lose contact with their command. They will also direct walking wounded to their proper destination.

At the battalion aid post (collecting point) will be stationed two battalion medical officers with one sergeant and eight privates, Medical Department. It will be the duty of these officers to see that the wounded are given the necessary attention and to maintain liaison with the ambulance company personnel who are charged with evacuating wounded from this point to the ambulance head. The more highly trained permanent sanitary personnel of the regiment should be utilized as much as possible for the application of dressings, including splints to the wounded, while the attached litter bearers from line troops are used for the actual littering of the wounded to the collecting points. Antitetanic serum will be given at the battalion aid post when practicable.

The responsibility for the care and evacuation of the wounded ceases for the regimental sanitary personnel the moment the case leaves the battalion aid post en route to the ambulance head.

DIVISIONAL SANITARY TRAIN

Ambulance company section

1. It will be the duty of the litter bearers from the ambulance company section of the divisional sanitary train to litter the wounded from the battalion aid posts (collecting points) to the ambulance head. One officer from the ambulance company section of the divisional sanitary train will be detailed with each regiment. His station will be at the battalion aid

post and he will be responsible for the evacuation of wounded from this point to the ambulance head. If there is more than one battalion aid post he will supervise the evacuation from each. He will maintain close liaison between the regimental and ambulance company service.

2. *Ambulance head.*—The ambulance head is the farthest point forward to which ambulances can go with reasonable safety. It is the point to which cases are littered from the battalion aid posts and where they are first placed in an ambulance. It should be on a good road if possible. From the ambulance head, patients will be carried by ambulance to the triage.

3. *Ambulance dressing station.*—An ambulance dressing station will be established about midway between the ambulance head and the triage. With the narrow front usually held in open warfare, one ambulance dressing station will usually be sufficient. Before an engagement opens, however, it may not be possible to forecast with certainty which path the stream of casualties will follow. In this event, it will be wise to send enough equipment to two or three points to establish nuclei of dressing stations. If later it is found that these stations are not needed, they should be withdrawn and only those retained which are really necessary. At the ambulance dressing station, only those cases will be removed whose condition requires attention. Shock tables will be installed so that cases needing shock treatment may be cared for. Cases which do not need attention at this point will be immediately sent on to the triage. Shock cases as soon as sufficiently recovered will be sent on to the triage.

There are times when only Ford ambulances can operate in advance areas; roads are in such condition that the heavier ambulances can not get through. In this event, the Ford ambulances should be used to bring cases to the ambulance dressing station, and at this point they will be transferred to the heavier ambulances. This will necessitate, of course, the establishment of the ambulance dressing station at a point which the heavier ambulances can reach.

The ambulance dressing station should be on a good road if possible. It must be on a return road and should have shelter if such can be procured.

4. During active operations, when the number of casualties becomes very large, it will be found that the available ambulance transportation will be entirely insufficient to carry all wounded and gassed to the rear and to prevent congestion in the front areas. It therefore is necessary for division surgeons to keep in liaison with the division motor transport officer and to secure the use of as many trucks as possible to carry back lightly wounded, lightly gassed, and lightly sick cases. Severely wounded and severely gassed must be carried in ambulances only. The corps surgeon will give every possible assistance to division surgeons during such periods of stress and will utilize for this purpose all available ambulances within the corps. Motor transportation (trucks) of sanitary train will be utilized to their capacity in transporting lightly wounded, lightly sick, and lightly gassed.

5. Close liaison must be maintained in the division between the director of the ambulance company section and the director of the field hospital section of the divisional sanitary train. The commanding officer of the sanitary train under the supervision of the division surgeon will see that this liaison is constantly maintained. It is particularly important that the director of the ambulance section know immediately when any change is made in the location of the triage so that ambulances may be properly directed. Otherwise much confusion and loss of valuable time will result.

6. The station of the division surgeon, commanding officer, sanitary train, and director of field hospital section, divisional sanitary train, will normally be at the place where the field hospitals are grouped. The division surgeon must be in close liaison, however, with the division post of command. This may be accomplished by stationing a subordinate medical officer at that point to keep the Division Surgeon informed as to changes in the tactical situation. The station of the director of ambulance section, divisional sanitary train, will normally be at the ambulance dressing station.

7. Roads in the vicinity of all divisional sanitary formations will be plainly marked so that ambulance drivers may locate them without trouble. The divisional assistant provost marshal will be kept advised of the location of all sanitary units and of any changes made so that the military police will be competent at all times to give necessary and intelligent instructions as to their location.

Field hospital section

1. Field Hospitals will be utilized as follows:

- | | |
|---------------------------|-----------|
| (a) Hospital for wounded. | } Triage. |
| (b) Hospital for sick. | |
| (c) Hospital for gassed. | |
| (d) Hospital in reserve. | |

Wherever possible the field hospitals will be grouped in one place. They will be placed at a point far enough from the front line as to be reasonably safe from enemy shell fire. This will ordinarily be from 10 to 12 km. from the front. They will be plainly marked with the red cross. They will not be placed near an important crossroads, ammunition dump, important bridge, or a battery position. Any one of the above places are subject at any time to enemy shell fire. In order to avoid interference with traffic, it is better to place them on a side road rather than a main road. In either case, a cut-out should be constructed so that ambulances will not stop on the road but will be directed into the cut-out. They must be on a return road, which should, of course, be as good a road as can be found. There is no advantage in placing them so far forward as to be subjected to shell fire; on the other hand, the disadvantages are obvious. It can not be hoped, of course, to invariably escape shelling, of back areas. Shelter in buildings is most advantageous if it can be secured. If such can not be secured, the field hospital tentage will be utilized for that purpose.

2. *Triage*.—The triage, therefore, is a group of three field hospitals. All cases come to the main receiving tent, from which they are at once diverted in three streams—all wounded to the hospital for wounded, all sick to the hospital for sick, and all gassed to the hospital for gassed. At these three places the real sorting takes place.

The saving in ambulance transportation and in general efficiency is administration that results from having these hospitals grouped in one place at once becomes evident.

All cases from the front must pass through this group of field hospitals.

3. *Hospital for wounded*.—At the hospital for wounded, in addition to the personnel of the field hospital conducting it, will be stationed the following medical officers: Division orthopedist; a medical officer with good surgical experience and judgment.

The division orthopedist will examine all fracture cases and cases having joint injuries and will see that all cases are properly splinted before being sent to the rear. Insistence must be laid on the fact that fractures and joint injuries should, whenever possible, be splinted where they fall. In all events, they must never pass through the hospital for wounded without having this properly done.

The medical officer with good surgical experience and judgment who is selected for duty at this point will examine all wounds and direct to which hospital each case will be sent.

4. All wounded will be examined, dressings adjusted, and hemorrhage controlled if necessary, antitetanic serum administered if not already done, food and hot drinks given where permissible, and shock treated when the patient's condition makes it necessary. They will be sorted and placed under shelter while awaiting transportation to the rear. They will not, however, be disturbed any more than is absolutely necessary. Unnecessary handling of cases causes much suffering to the patient, increases his shock, and multiplies enormously his chances for infection. There has been too much tendency in the past to renew dressings when such was not actually necessary.

Shock tables will be installed, so that cases needing shock treatment may be properly cared for. Cases in shock will be held, if military conditions permit, until their condition permits transportation to the rear.

5. All wounded will be divided into three groups: (a) Transportable lying; (b) transportable sitting; (c) nontransportable.

The transportable cases will be held in two groups (lying and sitting), under shelter, until ambulance or truck transportation is available for their removal to the rear. This will be done as quickly as possible and should be direct from the field hospital for wounded to the evacuation hospital. Cases, especially those showing shock symptoms, must be kept warm during transit. Canteens make excellent hot-water containers. An ample supply can usually be obtained from salvage. They should be placed around each shocked case that is to be transported by ambulance to the rear.

Nontransportable wounded will be sent direct to the hospital designated for such cases.

This hospital should be as near the triage as possible, preferably in the same plot, so that the time and handling from triage to hospital will be reduced to the minimum.

At this hospital will be finally held only those cases whose transportation farther to the rear will mean death. These cases should not represent more than one-half to 1 per cent of the total casualties. Not more than two surgical teams should be required. The cases which should be operated here will resolve themselves very largely into bleeding abdominal wounds and badly shocked extremities. Head, chest, and nonbleeding abdominal wounds will ordinarily stand transportation farther to the rear without greatly compromising their chances.

After operation, nontransportable cases will be sent to the evacuation hospital as soon as they are able to stand transportation.

6. In transportation by ambulance, it is essential that cases be not mixed—place sick in one ambulance, gassed in one ambulance, and wounded in one ambulance. It is easily seen that a wounded man may be also gassed by placing him in the same ambulance with a gas casualty. Likewise a wounded or gassed man may be infected with influenza by placing him in an ambulance with one suffering from that infection. A man who is both gassed and wounded will be placed in an ambulance for gassed cases.

7. In times of activity, when wounded are coming in rapidly, transport the wounded first, allowing the sick and gassed to wait until the rush has subsided. Delay for wounded men is more dangerous than it is for sick or gassed. Segregation of sick, wounded, and gassed in groups as outlined above renders this procedure a simple matter.

8. Each division surgeon will name a medical officer of good judgment and experience who will have charge of and be responsible for the shock work at the field hospital for wounded. This is a most important function which, if properly performed, will save many lives. In order to insure, however, that it be properly done it is necessary that one man be held responsible for the work. He will be responsible for the collection of necessary supplies and apparatus and the training of enlisted personnel. He will determine when the shocked patient is fit for further transportation. When the triage and the hospital for nontransportable wounded are adjacent, all cases in shock will be sent to the latter place. Here they will get the necessary shock treatment and final decision made as to whether they shall be operated on here or transported to the evacuation hospital. If there is a division internist, he will be the officer designated to take charge of shock treatment. Careful blanketing is a most potent means for preventing shock.

9. *Hospital for sick.*—All sick of whatever character will be sent from the receiving tent immediately to the field hospital for sick. In this field hospital, in addition to the personnel conducting the hospital, will be stationed: Division internist; division psychiatrist.

10. The division internist will see that all cases are as carefully examined as time and circumstances permit. He will separate cases, except those of a nervous character, into the following groups and dispose of them as indicated:

(a) Those fit for duty at once will be returned to their organization immediately.

(b) Those who will be fit for duty in two days will be retained at this field hospital and returned from this point to their organization when they have recovered. Any of these cases later showing serious symptoms will be transferred at once to the evacuation hospital. This refers to times of activity, with many casualties passing through. In quiet periods medical cases who will be ready for duty within four or five days may be held. No really sick man, however, such as dysentery, influenza, pneumonia, etc., must be held under any circumstances longer than is necessary to secure transportation to the rear.

(c) Those who are not seriously sick, but who will be incapacitated for from two to seven days, will be sent to the corps rest camp when such is established. If not established, they will be sent to the evacuation hospital.

(d) All others except contagious will be sent direct to the evacuation hospital.

(e) Contagious diseases to contagious hospital.

(f) During active operations, venereal cases, except those having disabling complications such as orchitis, epididymitis, or infectious stages of syphilis, must be retained for full duty at the front.

11. The division psychiatrist will examine all cases of concussion, suspected simulation, and other nervous conditions that are sent to this hospital. He will group the cases coming under his observation in the same way and make the same disposition as directed above for other medical cases by the division internist.

12. *Gas hospital (divisional).*—To this field hospital will be sent immediately from the receiving tent all gas casualties. The division medical gas officer will be stationed at this hospital. He will supervise the sorting of the cases and their proper treatment. Facilities must be provided to give the necessary special treatment—a proper bathing, alkaline treatment, administration of oxygen, and, if necessary, venesection. A shock table will also be provided for the treatment of such cases as need shock treatment.

The gas hospital must be located near a satisfactory water supply.

All cases will be divided, under the supervision of the division medical gas officer, into the following groups and disposed of as indicated:

(a) Those fit for immediate duty, who will be returned at once to their organization.

(b) Those who will be fit for duty in 24 hours. These will be retained at this field hospital and returned to their organization when they have recovered.

(c) All others, who will be sent to the evacuation hospital.

13. In past experience during open warfare it has been found that large numbers of men return from the front diagnosed as concussion, suspected simulation, or other nervous disorder or gas casualties. The great majority of these men present neither of the above conditions, but are simply exhausted, mentally and physically. They are disabled for the time being, but should not be sent to evacuation hospitals. They must be held in divisional or corps sanitary organizations, given the necessary food, bath when possible, and an opportunity to thoroughly rest. It will be found that within one to three days they will be able to return to full duty at the front, thus saving a very marked loss of man power when the maintenance of the man power of a division at its full strength is most important. Any such cases subsequently developing serious symptoms will be at once transferred to an evacuation hospital.

14. *One field hospital in reserve.*—This will be utilized to give assistance whenever needed, both in personnel and equipment. When necessary to move sanitary formations farther to the front, this field hospital will be sent forward to establish the new triage. When it is ready to function, the other units will be brought up as quickly as possible.

15. In each division should be established a hospital for nontransportable wounded. The following equipment and personnel will be all that is necessary:

- 1 small Bessonneau tent for operating room.
- 1 or 2 ward tents for wards.
- 50 cots.
- 150 blankets.
- 1 field operating case (large).
- 6 dozen quarter-pound cans ether.
- 2 gallons alcohol.
- 2 dozen hemostats.
- 1 instrument boiler.
- 4 hand basins.
- 1 dozen small operating sheets.
- 4 dozen towels.
- 1,200 gauze sponges, 4 by 4.
- 100 gauze pads, 9 by 9.
- 100 chest or abdominal binders.
- 100 chest or abdominal dressings.
- 100 4-inch bandages.
- 100 6-inch bandages.
- 2 5-yard rolls adhesive plaster.
- 1 dozen intestinal needles, straight.
- 1 dozen intestinal needles, curved (Mayo No. 12).
- 2 dozen packages intestinal silk or linen.
- 1 dozen tubes No. "0" chromic catgut.

- 1 dozen tubes No. 1 chromic catgut.
- 1 dozen tubes No. 2 chromic catgut.
- 1 dozen tubes No. "0" plain catgut.
- 1 dozen tubes No. 1 plain catgut.
- 1 dozen tubes No. 2 plain catgut.
- 1 dozen rubber gloves, No. 7½.
- 1 dozen rubber gloves, No. 8.
- 2 operating tables.
- 1 bolt unsterile surgical gauze.

This is in addition to the regular equipment for treatment of shock.

The linen and dressings can be obtained from the nearest evacuation hospital already sterilized.

The personnel should consist of two operating teams, composed of operator, assistant, and anesthetist. Two medical officers and 20 men from the personnel of the field hospital section, sanitary train, will be necessary for pre and post operative care.

The above equipment can all be carried on two 3-ton trucks.

Care must be taken that these organizations be kept absolutely mobile at all times. The tendency is to accumulate too much material and to attempt entirely too much surgery. The proper location for a hospital for nontransportable wounded is in close proximity to the triage so that these cases may be carried by litter from the triage to this hospital. This saves ambulance transportation and, further, saves time and much jolting with the consequent increases in shock for a class of desperately wounded men whose only chance for life rests in immediate skillful operation.

Two surgical teams will be sufficient to care for all cases that should be operated here. Experience has shown that two groups will cover practically all real nontransportables—(a) bleeding abdominal wounds, (b) badly shocked extremities (tourniquet). Ordinary abdominal wounds, head and chest cases will stand transportation farther to the rear where the increased facilities for operation and after care, particularly the latter, will more than compensate for the earlier operation.

In case this operating unit is located adjacent to the triage, all shock cases coming to the latter place should immediately be sent to this field hospital. After shock has been combatted, final decision will be made as to the necessity for operation. If a real nontransportable, operate; if the case will stand transportation to the rear, make ample provision to keep him warm in transit and send him to the evacuation hospital.

Cases will of course be evacuated to the rear just as soon after operation as their condition will permit.

In case there are not enough surgical teams to furnish two teams for each division in the corps, six teams for the corps will be sufficient to carry on the work inasmuch as there are rarely more than three divisions in the line at one time. These teams could then be shifted from one division to another as occasion demanded. In case the divisional triage with the hospital for nontransportable moved forward, it would be necessary for the corps sanitary train to take care of any cases remaining in this hospital who were not in condition to be evacuated to evacuation hospitals.

It will be noted that no X-ray equipment or sterilizing equipment for dressings is provided in the list furnished. This reduces the bulk to be transported by a considerable amount. X-ray equipment and equipment for sterilization of dressings is not necessary for this hospital.

The above equipment and surgical personnel should be attached to and operate with the field hospital for wounded.

16. It must always be borne in mind that divisional hospitals must be as rapidly cleared as is possible in order that they may be mobile at all times.

17. *Exchange of supplies.*—It is of utmost importance that a systematic exchange of supplies—as litters, dressings, splints, blankets, hot-water bottles—operating from the front line all the way back to the final hospital to which the patient is delivered be instituted at once. When a patient is placed in an ambulance, the ambulance orderly must return to the litter bearers a duplicate of all supplies furnished the patient. Similarly, when the ambulance delivers the patient to a hospital he must get from the hospital a duplicate of all supplies furnished the patient. This must operate at every point where a change of transportation

is made. Otherwise, the supplies at the front-line positions will soon become exhausted and unnecessary delay and suffering result. If this system of exchange is enforced, there is a constant steady stream of all necessary supplies going forward and there need be no interruption in the care given to wounded or other casualties.

If casualties are evacuated in trucks which do not return to division hospitals, blankets, litters, and other supplies should be returned by evacuation hospitals to the first ambulance which will return to the division.

18. For the purpose of securing proper records it will be wise to have placed at each triage an intelligence officer and an officer from the statistical section, with sufficient clerks. By this arrangement all necessary data can be obtained by these officers immediately upon entrance of cases at the triage, thus saving much time and subsequent paper work.

CORPS SANITARY TRAIN

1. Corps ambulance companies will be utilized under the direction of the commanding officer, corps sanitary train, to evacuate corps field hospitals and to lend all possible assistance in evacuating sick and wounded from divisional sanitary formations.

2. Corps field hospitals will be grouped at a central point, with good road facilities to all divisions in the corps. Three of these field hospitals will be utilized to form a corps rest camp. The fourth field hospital will be held in reserve for such use, both of personnel and equipment, as may be required.

To the corps rest camp will be sent the following class of cases:

(a) All sick from divisions and from corps troops who will be incapacitated longer than two days. The corps rest camp will hold all those who will be fit for duty within 10 days and will evacuate all others to an evacuation hospital.

(b) Return of cases fit for duty from evacuation hospitals.

Arrangements will be made with all evacuation hospitals draining the corps area to return to the corps rest camp all cases who are fit to return from the evacuation hospital to duty. Particular attention will be paid to gas hospitals in order to prevent the large number of pseudo or slightly gassed cases from getting farther to the rear. This will prevent the loss of those men to combat divisions who through error or by reason of slight illness or injury got into evacuation hospitals instead of being treated in divisional or corps sanitary organizations. It will amount to many hundreds of cases during a period of activity and is therefore a most important function. The commanding officer, corps sanitary train, is charged with keeping in liaison with evacuation hospital authorities in order to assure that all such cases are turned over to the rest camp instead of being evacuated to base hospitals or other formations in the rear. He will also keep in liaison with the proper divisional authorities in order to make satisfactory arrangements to have these men returned from the corps rest camp to a specific point in the division and thus avoid their wandering about the country looking for the organizations. He will make the necessary arrangements to assure that these men are properly equipped. (G. O. 111, sec. 7, par. 2, c. s.)

In order that these men may return to their organizations in good physical condition, the commanding officer, corps sanitary train, will institute a program of physical training sufficient to keep the men well occupied and so graduated as to insure a gradual return of full physical strength before returning them to full duty at the front.

(c) In case the hospital for slightly wounded is located a long distance from divisional triages, the corps rest camp may be utilized as a relay point for slightly wounded. To this point will be brought from the divisional triages all sitting wounded. From this point the sitting wounded will be evacuated by the corps ambulance or truck transportation to the appropriate evacuation hospital. No operations will be attempted.

3. In order to assure that ambulances get to their proper destination, the commanding officer, corps sanitary train, will station enlisted men at such road points as may be necessary, whose duty will be to direct ambulances to the proper hospital. They will be supplied with illuminated signs at night (an ordinary box with the lid replaced by sheeting and illuminated by candles will be sufficient). This will be under the immediate supervision of an officer of the day appointed by roster from the corps sanitary train.

The commanding officer, corps sanitary train, will keep in touch with evacuation hospitals, who will inform the former at regular intervals how many vacant beds are in each hospital. The commanding officer, corps sanitary train, will transmit this information to the enlisted men at the road points mentioned. These enlisted men will then be able at all times to properly direct all ambulances. Road congestion is frequently so marked and telephone service so unreliable during active operations that it becomes impossible to keep the evacuating officer at the triage informed as to the vacant beds in various hospitals. Unless such guides as noted above are placed, much time is lost and transportation wasted by peddling cases from one hospital to another hunting for one that has vacant space.

A medical officer from the corps sanitary train will be placed at the triage of each division in the line. He will be responsible for the evacuation from the triage and the proper instruction of ambulance drivers and orderlies as to routes and hospitals.

A medical officer from the corps sanitary train will be stationed at each evacuation hospital draining the corps area, if these hospitals are grouped. If not grouped, then at as many of the more important hospitals as is possible. His duties will be to supervise the unloading of ambulances, the exchange of supplies, instruction of drivers and orderlies as to their return, and any other points concerning the ambulance service that may arise.

With the corps sanitary train officers at the triages and evacuation hospitals and with road guides under the supervision of an officer of the day at properly selected road points, there should be no difficulty in keeping ambulances properly directed.

EVACUATION HOSPITALS

1. These come under the supervision of the army.

For efficient and economical evacuation, evacuation hospitals should be grouped. For a corps area, two groups should be provided, each of course on a railroad.

At each group should be accepted all cases without a question that are brought to it. There should be a gas section, a medical section, and a surgical section, to each of which are sent the appropriate class of cases immediately upon arrival.

The need for a medical service at each evacuation hospital is obvious.

In the surgical section a careful triage of all wounded will be made. Separate surgical services for slightly wounded and severely wounded will be provided, each with its own personnel and each concentrating exclusively on one or the other class of cases.

Close attention should be paid to the slightly wounded, for this class represents a valuable military asset. Early and expert surgical service assures their return to the line at an early date, and represents, therefore, a very decided saving in man power.

The present method of having evacuation hospitals scattered widely over an area is very unsatisfactory for the following reasons:

- (a) Drivers of ambulances have great difficulty in locating the various hospitals.
- (b) They learn the way to one hospital and concentrate on it. The result is congestion there, while another equally well-equipped institution but less accessible will have little to do.
- (c) Much time is lost, with resulting suffering and damage to the patient.
- (d) Great increase in ambulance transportation required.
- (e) It has happened quite frequently that a hospital does not agree with the selection made at the triage and will therefore not accept the cases, or will accept only a portion of those in the ambulance. The others are directed to another hospital and from there perhaps to a third. Grouping of hospitals with acceptances of all classes of cases would remove the possibility of this peddling of cases.
- (f) Increased economy in utilizing available hospital space. If hospitals were grouped, it would be a simple matter to utilize all available space. When widely separated, it frequently happens that one is crowded while the other is almost empty; and with the difficulty in telephonic communication and the lack of transportation, it is not always easy to get the stream properly diverted. It is true that close liaison between the army and corps should largely obviate this, but in any event grouping of hospitals would absolutely eliminate the difficulty.
- (g) Grouping of evacuation hospitals would also greatly facilitate the evacuation of cases from this point farther to the rear.

2. If the evacuation hospitals can not be grouped, the only alteration required in the above plan would be that a more careful sorting of surgical cases would be necessary at the divisional triage.

3. It is felt that mobile hospitals should be under the control of the corps surgeon—two to a corps. They should be placed as far forward as possible and should receive the very seriously wounded who do not fall into the class of actual nontransportables as previously noted.

Being under the control of the corps surgeon, who is in close touch with actual conditions at the front and has better knowledge of roads and terrain, they can be moved forward more advantageously and with much less delay than when the corps surgeon does not exercise control. It would make decidedly for efficiency.

Army Sanitary School No. 155.

ARMY HOSPITALS

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It has been the object of this paper to collect in one communication some of the principal points covering the establishment, regulation, and function of mobile and evacuation hospitals as they have been seen in operation in four areas of our army activity from August 4 to November 11. Many of the good features are perhaps not included through failure to appreciate them all. Many of the weak points and reasons for inefficiency are likewise omitted. It is hoped, however, that this presentation of the subject will serve in a measure to direct attention to a very definite and important area of our activity as medical officers, which, in the experience of most of us is new, peculiar, and lacking in definite regulations.

The subject has been dealt with under the heads of: I. Instructions to commanding officers of evacuation, mobile, and special hospitals, covering the points (a) location and establishment, (b) collection of patients from triages, (c) admission of patients to hospital, (d) the receiving ward, (e) triage, (f) evacuation, (g) professional work, (h) mess. II. Regulations. III. Function of mobile and evacuation hospitals. IV. Standard types of evacuation and mobile hospitals. V. Ground plans. VI. Army hospital centers.

Some of these subjects have been covered in a way as they would be covered in regulations or by an army chief surgeon in his memoranda to the commanding officers of hospitals. In this form, definite and at times dogmatic statements are made to cover ideal conditions in order that those concerned may, as it were, "have a mark to shoot at," and critics may agree or disagree. It is hoped that with the outline presented, subtractions and additions may result in a fairly definite plan for the establishment, regulation, and function of these hospitals.

I. INSTRUCTIONS TO COMMANDING OFFICERS OF MOBILE, EVACUATION, AND SPECIAL HOSPITALS

The work to be performed in these hospitals in so far as it has to do with the professional care of patients is presumed to be fully understood by the commanding officers and personnel. Consultants in the various branches of medicine and surgery on duty in the chief surgeon's office will be sent to the hospital for the purpose of inspection and instruction of the members of the staff. In addition to the proper surgical and medical attention required by the patient, there are other features particularly administrative which require careful attention and regulation.

(a) *Location and establishment.*—(1) Mobile hospitals, where practicable, will be established in a field located on a good road, which, with other roads, will drain a particular portion of the line which it is desired this hospital shall serve. In general, an attempt will be made to place this hospital from 2 to 3 km. back of the area of normal artillery fire, protected if possible from overshots by hills or ridges. In winter, these hospitals should be so located as to prevent their being subject to prevailing winds. This protection may be had from woods or hills, or in emergency a windbreak may be constructed by the personnel or by the camouflage service. Good ambulance roads to the receiving ward and through the evacuation area will be constructed by the engineers at the earliest practicable moment. Distribution of tentage, corridors, and latrines, together with the internal arrangement and function, will be made to conform to circumstances found to exist.

(2) Evacuation hospitals will be established along a standard-gauge railway where a siding suitable for loading is at hand, or where such siding may be put in. Specifications regarding sanitary sidings will be given under "ground plans." It will be the endeavor of the chief surgeon to establish these hospitals as near the front as is possible. Such establishment, however, will depend upon existing railways or railway construction, so that evacuation hospitals will be established, in the main, a short distance back of railhead. The establishment of special hospitals will be avoided, except perhaps those for the treatment of neuropsychiatric cases. In some instances, gas hospitals will be established as departments of established evacuation hospitals.

(b) *Collection of patients from triages.*—This work will be under the control of the corps surgeon and, in general, will be performed in the following manner:

An officer of the evacuation ambulance service will be placed in charge of ambulance evacuation for one or more divisional triages. He will be given a suitable number of ambulances, with instructions covering proper triage evacuation. He will be supplied, from time to time, by the corps surgeon with information regarding roads to the rear; bed capacity available in the various hospitals; changes in location of hospitals and triages. This officer will be held responsible for the proper transportation to mobile, special, or designated evacuation hospitals, as the requirements of the situation demand, sending cases designated "mobile hospital" to the nearest mobile hospital having available beds; gas cases to the nearest hospital having facilities and bed space for gas cases, etc. This officer will see that signs are placed along all roads leading to the hospitals in the rear. He will personally direct the placing of these signs and will see that they are of such size and character as to clearly indicate the route to be followed. Particular attention will be paid to crossroads. Each sign will give the following information: "Evacuation Hospital No. —, Seully (with an arrow pointing the direction to be taken), 5.5 km." These signs will be illuminated at night. He will furnish the ambulance driver a slip containing the following information:

Date -----

----- Triage. (10 a. m.) Departed. (11 a. m.) Arrived.

1. -----

(Maximum speed allowed)

2. -----

(Name, number and location of hospital)

3. ----- splints; ----- blankets to be returned.

A space will be available on this slip for the initial or stamp of the receiving hospital which will indicate that the patients have been received. The evacuation ambulance officer will take the necessary precautions to assure himself that cases dispatched to the various hospitals are being received and that they are not diverted to other hospitals by ambulance drivers without authority; as in the past, ambulance drivers have shown a tendency to deliver cases to hospitals other than those to which they have been directed, with the result that certain hospitals have been overcrowded, while others have not received their share of the work.

(c) *Admission of patients to hospitals.*—Information will be furnished corps and division surgeons regarding the location of hospitals and the work to be performed by them. This information will be found in army, corps, and division orders. Corps and division surgeons will be responsible for the proper selection, classification, and loading of cases at triages and for the information regarding their classification and the hospital to which they are to be delivered. The commanding officer of each hospital will receive instructions in writing covering the work to be performed in his hospital. When the hospital is established and ready to receive patients, a soldier of intelligence will be placed at the entrance to the hospital with instructions to supply information to ambulance drivers regarding this hospital or other hospitals in the area. Upon arrival at the receiving ward of the hospital, the ambulance driver will present his "destination slip" to the noncommissioned officer in charge of the entrance. This noncommissioned officer will make certain that the cases have been designated by the evacuation ambulance officer for this particular hospital. Cases designated by the evacuation ambulance officer for delivery to this hospital will be received regardless of minor differences of opinion on the part of receiving officers and others. After their admission and examination in the

hospital by a competent officer, other disposition may be made of them by the chief surgeon. Officers responsible for classification and selection of cases at the divisional and corps triages often work under very great difficulty and it is expected that disagreements in classification will occur. Again certain cases will combine two or more classifications; for example, as where a wounded man has also been gassed.

One of the most frequent and serious causes of embarrassment and inefficiency in evacuation and mobile hospitals has resulted from inefficiency in the receiving ward, the result in most instances of a lack of definite information or instruction on the subject of "admissions" and "receiving."

The capacity of a given hospital at a stated time to receive and properly care for patients is fixed and should be definitely understood by the commanding officer and the receiving officer; for example:

Bed capacity	-----beds.
Patients in hospital	-----
Patients awaiting operation	-----
Operating teams on duty	-----
Operation rate for heavy cases	-----
Operation rate for light cases	-----
Average operation rate	-----
Evacuation time required for transportation of preoperative cases to base hospital in the rear	-----hours.

With this information at hand it will be apparent that 500 cases requiring operation should not be received without the chief surgeon's order if the operation rate of this hospital is 100 cases in 24 hours where a base hospital prepared to care for and receive preoperative cases is located two hours to the rear. The evacuation time required for preoperative cases to base hospital being known, the number of cases awaiting operation which should be allowed in any hospital can be definitely stated if the operation rate of the hospital is known. When any evacuation hospital has received 75 per cent of this number of preoperative or "cases awaiting operation," notice should be given the chief surgeon's office of the fact, when redistribution from the front may be ordered through the corps surgeon, added teams and personnel may be sent, or preparations may be commenced for preoperative evacuation of cases which have been carefully selected according to definite regulations covering this class of evacuation. The most careful and painstaking attention should be taken in this matter of receiving cases, as complete demoralization with unnecessary suffering from lack of attention and surgical care result when hospitals become overcrowded or filled beyond their operating or bed capacity. This condition has been known to exist in hospitals where other hospitals in the immediate neighborhood have been relatively idle. The remedy is simple and apparent and commanding officers will be held strictly to account for efficient administration covering the details of admission rate and timely notification of the chief surgeon regarding the status of their hospital.

(d) *The receiving ward.*—The receiving ward of a 1,000-bed evacuation hospital should be large enough to accommodate 150 sitting and 30 litter patients. It should be well heated and lighted and should have a good floor. Benches and litter racks for this number of patients should be installed. A safe or strong box for safe-keeping of valuables and decorations is necessary. Provision for the administration of hot drinks should be made. Experienced clerks with typewriters should be located at desks where the field medical card, Forms 52 and 22, are made out. There should be sufficient litter bearers to properly litter and assist patients from the ambulances into the receiving ward and to distribute them from the receiving ward to the various departments of the hospital to which they may require distribution.

(e) *Triage.*—This consists of prompt separation in the receiving ward into surgical, medical, and gassed. These are again separated into walking, litter, contagious, noncontagious, seriously wounded, slightly wounded, shock, and urgent. This work is done by the triage officer, who is responsible for prompt designation of the various classes mentioned. He is also charged with the proper conduct of the receiving ward and care of patients until their arrival at the various points of distribution from the receiving ward. He may require

the assistance, especially in rush times, of trained medical officers; at other times and after sufficient training, experienced noncommissioned officers may be competent to perform the work of assistants in the triage or sorting. Cases in shock among the surgical patients should be sought out and sent to the shock ward at once. Medical cases, on account of possible contagions, should be promptly segregated and masked if necessary. The medical cases should be distributed soon after their arrival. Walking medical and surgical groups are conducted past the deck, where the three clerks prepare, at one reading of the diagnosis tag, the field medical card covering the points of triage and subsequent course of the cases through the hospital. This might be termed a provisional triage, as these cases are subject to redistribution should this be found necessary in the slightly wounded, severely wounded, or medical sections of the triage, operating rooms, or wards. Thus the triage officer will designate medical by capital "M"; "C" following the "M" indicates contagious; "S" severely wounded; "O" slightly wounded; "SH" shock; "U," or a red paster, indicates urgent operation. Here also the date and hour of the injury, with date and hour of admission to the hospital, are recorded. If A. T. S. has not been given, a yellow paster is attached to the F. M. C.

Cases are then distributed to (1) shock ward, (2) severely wounded section, (3) slight and walking wounded section, and (4) medical section, contagious, noncontagious, and gassed. Where large numbers of gassed cases are being received, a special gas section should be arranged outside the general receiving ward. In each of the triage sections and wards the patient is placed in the most favorable position to receive quickly the special examination required by the case, as facilities are there at hand for the treatment or examination of these classes especially. In these wards with more careful examination further triage is directed, as, for instance, a shock patient is marked "X" for X ray; "OP" for operation, or "W" for ward. In the severely wounded triage he may be designated "S" for shock, or any of the designations previously mentioned in the case of shock patients. In the slightly and walking wounded triage, the patient may be marked "DR," dressing room, or any of the previous designations mentioned. In the dressing room the patient may be marked "EW," evacuation ward; "X," X ray; "OS," slightly wounded operating room, or any of these combinations as found necessary to cover the distribution or triage of the cases. Further triage may be directed in either of the operating rooms, where the patient may be marked "EW," evacuation ward; "H," hospitalize, and a note on the field medical card may even direct deferred evacuation upon reexamination. Further triage of medical cases may be done in the wards, after leaving the medical section of the triage. This applies especially to the evacuable or non-evacuable status of the case, though the case may be sent to contagious wards or convalescent camp from here.

Valuables, including decorations, should be carefully guarded, especially where the patient is to be operated upon; records should be kept accurately and receipt for them obtained upon evacuation of the case. Small bags such as the Dorothy bag are convenient and should be furnished for valuables and small articles which accompany the patient to the ward. Officers' clothes and those of the Allies accompany the patient through the hospital. Removal of clothing, its disposal or salvage, bathing and dressing in pajamas, and proper forwarding of cases occurs at the four points after preliminary or provisional triage; namely, in the shock ward, severely wounded section, slight and walking wounded section, and medical section. Special care should be taken in all of these wards and triage sections that exposure and chilling is avoided. Hot soups, cocoa, sufficient blankets properly applied, and hot-water bottles should be used judiciously in order that the patient's condition may be improved, if possible, prior to operation if required.

At intervals during the day the number of beds available in the various wards is recorded by a noncommissioned officer, and as patients are assigned an attempt is made to keep account of available vacant beds and their distribution. It is in this location—that is, in the receiving ward—that the status of the hospital is constantly kept in mind with a view to the prevention of overcrowding and with a view to the prevention (or at least notification of the chief surgeon) of inability to properly handle or digest surgical cases requiring operation.

(f) *Evacuation.*—Mobile and evacuation hospitals are not intended for and will not perform elective operations, nor will they retain evacuable medical cases for complete hos-

pitalization in time of battle or where action may occur at any time. The function of these hospitals is to prepare cases of all descriptions for evacuation at the earliest practicable moment, with assurance that evacuation will not result unfavorably for the patient or others. Retention of evacuable patients in either of these hospitals is in direct violation of the most essential feature of their function and will result disastrously sooner or later. For this reason, patients will be divided into evacuable and nonevacuable at the earliest practicable moment. Responsibility for this early division will rest with the commanding officer of the hospital, who will arrange the details and determination by properly selected officers along the following lines:

Where an operation is performed the operating surgeon will indicate on the field medical card, diagnosis tag, or by other means that the case is evacuable at once, or will be at the expiration of certain number of hours or days; or that he is not evacuable. The same note or notes will be made in the dressing room if operation is not performed. Cases in the surgical wards will be recorded as shown under regulations, at the earliest moment practicable. Medical cases will be decided for evacuation or hospitalization under the direction of the chief of the medical service or designated medical officer. Subsequent changes in designation for "hospitalization" or "evacuation," specifying whether the case is to be evacuated, "lying" or "sitting," as contagious or not, will be made by ward surgeons or operating surgeons responsible for the case in the wards, if necessary. A system of ward records which will show the number of cases evacuable, by name, location, and method, is described under "Regulations." Cases to be evacuated without operation must be selected with the greatest care, in accordance with definite rules and specifications laid down by the chief surgeon, and the decision will be recorded in writing on the field medical card or other record and will be signed by the officer making the decision.

An evacuation officer, with an entraining officer, a suitable number of assistants, and a "loading detail," should be designated in each hospital of sufficient size to require one or more of these details.

The commanding officer of the hospital will receive instructions regarding the total number of cases to be entrained, also the classification into "lying" and "sitting" cases, whether postoperative, preoperative, medical, gassed, contagious, or other classification. He will be held responsible for an accurate and recent check of patients loaded, in order that patients unsuited for evacuation for any reason may not be evacuated. He will not load more cases than he has been given authority to load, and he will see that classification of cases loaded conforms accurately with the authorization given him. Great inconvenience, unnecessary suffering, and death have resulted from careless and inaccurate evacuation.

The evacuation area, so-called, meaning the portion of the hospital situated along the loading platform, is from the standpoint of the evacuation hospital an essential department. In this area are collected the cases from the hospital to which the area belongs, and in addition it collects, for evacuation, cases from mobile and other hospitals not located on the railway. The various tents for wards for surgery, medicine, gassed (lying and sitting) are designated and used for these cases, as far as practicable. These wards and the area are under the direction and control of the evacuation officer. He will be responsible for systematic arrangement, attention to feeding, inspection of cases therein to detect shock, for inspection of dressings, splints, and clothing, to see that they are sufficient and properly applied. When an evacuation is ordered, a trainload will be made up by the evacuation officer from selected cases conforming to the requirements and specifications of the train to be loaded. In favorable weather, litter cases may be placed on the loading quay, head outward, shortly before the arrival of the train. Walking cases should be collected and placed under the direction of a none commissioned officer, who will see that these cases do not wander away or cause confusion in the loading by wandering about the platform. Upon the arrival of the train the evacuation officer will receive from the train commander his designation of cars for sitting, lying, contagious, medical, and other classes, and will proceed to mark the designated cars with legible signs indicating class of cases to be loaded therein. Litter cases are loaded first and sitting cases afterward. American trains are standard as a rule in so far as number of patients accommodated and uniformity of equipment are concerned. The average American train carries 480 sitting cases, with 120 lying

cases at the same time. This may be considered a typical load. Variation from this is necessary as a rule, and can be figured according to the following rule: For each additional lying case above 120, 2 sitting cases must be subtracted; example: With 150 litter cases the number of sitting cases which may be accommodated is figured as follows: 150 minus 120 equals 30; 30 multiplied by 2 is 60; 150 minus 60 is 90; 90 therefore represents the number of sitting cases that may be accommodated with 150 litter cases. American trains carry a contagious section which has been found to be exceptionally useful. By the use of the personnel car on short trips and the placing of patients on litters and benches in aisles and doorways, some trains have carried over 700 patients.

French trains are of various types and their capacity can not be intelligently figured so that information regarding their capacity must come from the regulating officer. These trains are not nearly so comfortable or well equipped as American trains and should not be relied upon for use if American trains are available, as difficulties in loading, feeding, and care of patients are numerous.

(g) *Professional work.*—The current dictum regarding professional work should be a matter of written orders based on the written memoranda of surgical and medical chiefs or special consultants of the chief surgeon's office. Frequent inspections of each hospital will be made by army consultants, who will inform the chief surgeon after verbal report to the commanding officer of the hospital concerned of necessary changes in personnel, technique, additional supplies, or other facilities for the care of wounded and sick. Sample memoranda from some of the hospitals are given herewith for use as a guide in framing similar regulations for surgical and medical services. Regulations for gas service should be similarly defined and published.

GENERAL PRINCIPLES GUIDING THE TREATMENT OF WOUNDS OF WAR

1. Speaking generally, every wound of war should be regarded as either contaminated or already infected.

2. The aims of treatment should be (a) to prevent the development of infection if the wound is merely soiled, or to sterilize it if infection has already developed; (b) to close the wound secondarily by suture when "clinical" sterilization has been obtained.

3. The general rule governing the treatment should be free opening up of the cavity, combined with resection of all contused and contaminated tissues, and removal of all fragments of clothing or other foreign bodies. No deviation from this rule is justifiable.

Pathogenesis of gas gangrene.—Under this heading the predisposing causes are considered.

For a moment, and from a surgical point of view, the most important rôle must be assigned to predisposing causes, because certain of these are more or less amenable to therapeutic measures. They may be divided into two classes: (a) General; (b) special.

(a) General causes: (1) Geographical distribution. The frequency of the clinical entity known as gas gangrene is to a considerable extent dependent on the locality in which patients may be wounded.

(2) Wounds inflicted by fragments of shells and bombs are the most dangerous variety.

(b) Special causes: (1) Localization of the injury in the fleshy parts of the limbs, especially in the lower extremity.

(2) The special characteristics of the wounds, such as narrow orifices associated with serious deep lesions.

(3) The impaction of foreign bodies, especially débris of clothing, which may carry soil, with all its contaminations or fecal material, with them.

(4) Extensive contusion of the tissues leading to mortification. Other predisposing causes, although of inconstant occurrence, are none the less frequent.

(5) Severe comminution of bones, or of fractures implicating joints.

(6) The ischemia dependent on injury to large vessels, obliteration of large vessels by ligature, or the prolonged application of the tourniquet.

(7) Multiplicity of wounds.

(8) The presence of a hematoma.

(9) Traumatic shock.

(10) The risks of gas gangrene diminish in direct proportion to the efficiency with which surgical measures are carried out, and the promptitude with which these measures are undertaken.

(11) Even when surgical intervention has been both prompt and efficient, the occurrence of gas gangrene may be favored by the employment of unsuitable methods of treatment, especially dressings which allow the wound to rapidly become dry.

(12) Attention should be directed to the investigation of certain factors in the toxemia accompanying gas gangrene, especially acidosis, local and general. Researches in this direction may result in the establishment of indications for treatment.

Bacteriology of gas gangrene.—(1) Researches carried out since the commencement of the war have confirmed the infectious origin of the process, and the anaerobic nature of the organisms that give rise to it.

(2) Amongst the organisms met with, special importance should be attributed to the *Vibrio septique*, *B. bellonensis* (the exact relations existing between *B. bellonensis* and *B. oedematiens* are not yet determined), and *B. perfringens*.

(3) The anaerobic infection is often aggravated in its effect by the association of other microorganisms, especially the streptococci.

(4) In consonance with the general principles of bacteriology, attempts should be made to obtain sera active against the organisms enumerated above, with a view to serum therapy. Such sera have been prepared and used with great effectiveness.

Treatment of gas gangrene.—(1) Gas gangrene is most often the consequence of delayed or inefficient primary surgical intervention.

(2) Prophylactic treatment is of the first importance; it includes rapid evacuation to a surgical unit in order that proper measures may be promptly taken, free exposure of the wound cavity in its whole extent, excision of contused or sloughing tissue, removal of all foreign bodies, incising facial planes to relieve subfacial hematomæ, and careful hemostasis.

(3) When the process is localized, whether the tissues are already infiltrated or not, the curative treatment consists in (a) complete exposure to the air of all deep recesses of the wound; (b) excision of all tissue already gangrenous or even open to suspicion; (c) free incisions in the zone of infiltration, and at the limit of that zone.

(4) Amputation is imperative; in the presence of acute massive gangrene, especially when complicated by lesions of the bones, or serious injury to the vessels; also in instances of very rapid extension with threatening general symptoms (rapid fall in tension of the pulse is a valuable symptom in this respect). The method of choice is the "flush" amputation.

When the amputation is carried through infiltrated tissues, additional incisions should be made in the infiltrated zone, extending upward to the limits of the limb or even on the trunk.

Shock.—It should be remembered that the soldier before his injury is in good physical condition, and if given rest, warmth, morphia, etc., will react remarkably well. Patients with a blood pressure much below 100 mm. Hg. should be considered as poor surgical risks, and may suitably be treated, where the opportunity offers, by additional methods, such as transfusion, etc. In these cases a local anesthetic (novocaine) or nitrous oxide is to be preferred to ether. Chest cases should be operated on under nitrous oxide anesthesia when available. This anesthetic should be one of choice when operations are performed on gassed cases.

Examinations.—One of the first duties of the chief operator is to examine thoroughly the entire surface of the body for all possible wounds and make note on the field medical card.

Débridement.—Wounds that are necessary on account of surgical interference should be thoroughly débrided, whereby the devitalized skin and muscle tissue and bone detached from periosteum is removed. This should be done in case of extremities under traction, in order to bring the parts as nearly as possible into the position in which they were when the wound was received. In wounds over three days old and with abscess, drainage of free pus should not have an extensive débridement for obvious reasons (opening up nature's inflammatory area of resistance). Through and through wounds from rifle bullets with punctiform entrance are not to be débrided or opened up, unless some contraindication for the above management is present, which has been made evident by great tension of the overlying tissues from hemorrhage or infection, made evident by marked tenderness, usually occurring in a wound three days or more old. In this case incision and exploration is demanded.

Nerve and blood vessel injury.—In all severe wounds of the extremities the operator should examine for possible nerve lesion before anesthetization and note preoperative as well as operative findings on F. M. C. when making operative note. If nerve is found severed, draw ends together with single fine silk suture and note fact. Ascertain whether pulsation is present in vessels beyond injury.

Tendons.—(a) Tendons should have a primary suture; (b) care as to undue freshening of the ends; (c) if not a primary suture, silk run into each end of the tendon. Above measures will facilitate the surgeon in finding tendon in any secondary operation.

Closure of wounds.—All wounds, except those noted below, should be left wide open. In dressing wounds, avoid packing with gauze, which prevents drainage and necessitates anesthesia for removal. The sides of the wound should be protected from contact with gauze by using gutta-percha tissue, cellophane, cellosilk, or other similar material, and when one of these is not at hand the gauze may be prevented from sticking by using vaseline. In no instance are wounds to be packed with gauze, or large drainage tubes inserted. In only exceptional cases are the wounds to be Dakinized in evacuation hospitals, owing to the inability for the proper moistening of wounds during the rush and transportation. Therefore, Dakin tubes are to be used conservatively in evacuation hospital service. The leaving of a skin wound open is a matter of choice in evacuation hospital service, as a large percentage of skin closures have been found infected at the base, destroying results of preliminary surgical procedures. If a wound is found clean, the delayed suturing of the skin is done at the base.

Head cases.—It is the policy of this institution to transfer head cases to the "head hospital," as they stand transportation better before than after operation. After operation they should be retained for at least 10 days. If operated here, entire head should be shaved (preferably dry) and they should be operated under local anesthetic, if possible. Every scalp wound conceals a possible penetrating wound, and many are found among the walking wounded. Drainage of wounds involving the brain is to be avoided. Primary closure and thorough cleaning of the tract, daily dressing, and prompt removal of a few sutures over the immediate tract on the first sign of infection.

Fractures.—(a) Simple fractures with soft part wounds not extending to bone: Remove foreign tract and clothing; débridement; treat bone as a simple fracture.

(b) Bone wounds: Débridement, with removal of foreign body and tract. Removal of infected layer of bone (do not close in evacuation hospital service).

(c) Compound-comminuted fractures: Débridement; removal of foreign body and all detached fragments; retarded primary suture; proper splinting.

(d) In general, fractures by machine-gun bullets do not require operation. Treat as simple fractures. About 90 per cent will not be infected.

Fractures will be evacuated here as soon as possible, as they stand transportation early if primary operation permits, better than late, and early transportation gets the patient to the base for more definite treatment than can be given at an evacuation hospital. Before evacuation, the splints should be carefully examined to ascertain their proper application and position.

Joints.—(a) Capsule of all joints to be closed when possible. No primary suture of soft parts unless cases can be kept in hospital one week. Postoperative aspiration if necessary. Immobilization with extension for 48 to 72 hours, then voluntary motion.

(b) Suppurative joints. Free incision without irrigation, with voluntary motion begun in six hours and repeated every two hours; no drainage into joints.

(c) Resections of joints are deprecated, except in exceptional cases. If resection is necessary, owing to extensive bone wounds or fracture of atypical resection is preferable. In the knee the operation should be primary, whereas in the elbow and shoulder secondary operation is preferable.

(d) In general, machine-gun or pistol wounds of joints should not be operated upon, unless definitely infected. Aspiration if necessary.

Amputations.—(a) In all cases of amputation or complete resection, a signed consultation with the chief of the surgical service, or his representative, is required.

(b) Preserve all skin.

(c) Preserve as much bone as possible.

(d) Preserve gliding surface of muscle for future cinematization.

(e) Traction to be made on skin.

(f) Preserve all muscle and tendons possible.

1. Amputation is indicated only when conservation of the limb would lead to the death of the patient, or if eventual loss of the limb is inevitable.

2. The two chief indications for amputations are (a) extent of the injury; (b) infection.

3. Amputations for infection are always the more dangerous.

4. The indications for primary amputation are found in the nature and extent of the injury—pulverization, crushing, partial avulsion of the limb, and especially rupture of the main blood vessels.

5. The indications for secondary amputation are found in massive gangrene, either ischemic or infective. Other extending infections (superficial gangrene) may be treated by conservative measures.

6. In primary amputations, especially those indicated by infection, the wound should be left widely open. Care should be taken not to open up the intermuscular planes. With this object the vessels and nerves should not be followed into the intermuscular clefts but should be cut long.

7. The length of the resulting stump is of more importance than perfection of its covering.

Amputations of the lower extremity.—Disarticulation of the hip joint is a more serious operation than amputation through the neck of the femur, even when performed by a request incision and with preliminary ligature of vessels.

For satisfactory fitting of an artificial limb an amputation through the thigh should leave the stump extending 12 to 14 cm. below the great trochanter.

Amputations through the upper fourth of the thigh are difficult to accommodate with an apparatus, in consequence of the abduction of the femur which has taken place.

Amputation through the middle and lower thirds of the thigh give good results. The great sciatic nerve should be divided above the level of the flaps.

Amputations of the leg should be performed at the lowest practicable level. A posterior flap appears to be preferable.

The fibula should be cut an inch shorter than the tibia.

Amputations of the upper extremities.—In amputations at the shoulder the head of the humerus should be preserved if possible.

Amputation of the arm should be performed at as low a level as is practicable. Either the circular or the flap method may be employed; 10 cm. of the humerus are necessary for a useful stump.

In the forearm every effort should be made to preserve a lever at least 10 cm. in length below the elbow joint, and to maintain the movement of pronation and supination.

In the hand, whenever possible, trimming operations should be adopted, since every segment which can be preserved may prove of great service.

Abdominal wounds.—Penetrating or perforating wounds of the abdomen, after 18 hours from the receipt of the injury, should not be operated without first consulting with the surgical chief or his representative.

Wounds of the kidney.—In wounds of the kidney, unless there are marked indications of hemorrhage or great destruction of tissue, the most conservative surgical methods are required.

Penetrating wounds of the chest.—Primary hemorrhage is common in both open and closed chest wounds. It is the chief cause of death during the first few hours after the receipt of the wound. When severe, the patient is blanched and restless. Treatment in these serious cases is mainly expectant. Patients with a readily perceptible pulse may die suddenly if rolled over on the wound side within 12 hours after being wounded. Bleeding does not usually continue after 24 hours. It usually comes from the deeper blood vessels in the lung. Nature's method of arresting it is to cause collapse of the lung. The pressure on the lung by the accumulated fluid in the pleural cavity will not by itself assist much in the arrest of the hemorrhage. No single case of hemorrhage from an intercostal artery has been seen. Plugging of the wound is therefore no benefit except after the lung is collapsed, when it may improve respiration by rendering the entrance of air into the chest easier by respira-

tory passages than through the wound. Hemoptysis was present in 65 out of 100 cases of undoubted penetrating wounds of the chest. In no case was it severe enough to cause anxiety.

Any wound which leaks air or blood and pleural fluid freely after 48 hours will become septic. Convalescence and invalidism are only greatly prolonged.

Treatment of these leaking cases is by simple dressing, by plugging the wound, or by sewing up the wound, with or without removal of the foreign body. The simple dressing is sufficient in cases of small wounds. Air will cease to leak in 24 to 48 hours. If it continues, or if the discharge persists, sepsis is almost certain, and resection and drainage is indicated.

Plugging the wound is done to arrest hemorrhage and to prevent the entrance of germ-laden air. It is, however, difficult to render a large wound air-tight with gauze, and therefore danger is present of introducing germs from the edge of the wound.

Sewing up the wound is advisable in all cases, since this means infection can be prevented in more than half of the cases. The removal of foreign bodies from the lung is justifiable only in selected cases. About 12 hours after being wounded is the best time for suture. Shock should have passed off and hemorrhage should have ceased. Muscle and pleura are sutured with catgut, the last stitch being drawn tight during expiration. If the pleural contents are infected, the wound will become moist in 24 hours. The stitches are then removed and a tube inserted. Nothing is gained by sewing holes or tears in the lungs.

Closed hemothorax differs in no way except from greater liability to increased intrathoracic pressure and cardiac displacements. Air in these cases comes from the lung. Rapid pulse, sustained temperature, and localized pain in the chest are signs of infection of hemothorax. Chest cases should be examined each day, special attention being directed to the position of the cardiac impulse. Aspiration should be performed when there is cardiac displacement of 1 inch or more. All the fluid that will run off easily is removed slowly at the rate of about 30 c. c. per minute. Practically all hemopneumothorax cases require aspiration. Do not close skin.

Injury to the nerves.—(1) It is indispensable that all lesions of the peripheral nerves should be investigated with the greatest care in the hospital at the front when the wound is subjected to primary treatment; both with regard to the clinical signs present, and direct examination of the nerve trunk itself.

(2) Whenever a divided nerve trunk is discovered, it should be united by primary suture, if the condition of the wound permits. A special note describing the operation performed should accompany any patient so treated when he is evacuated.

(3) If primary suture is impracticable, a long silk suture left long on each end should be left in the wound.

(4) Either the primary or secondary operation may suffice to obtain restoration of function; but should they fail, the operation has, at least, insured that the trunk is placed under the best conditions for later intervention.

(5) During the whole course of treatment, care must be exercised that the limb is kept in good condition, and that the mobility of the joints and the nutrition of the muscle is maintained. Be sure that nerve and tendon lesions are properly splinted.

(6) Operations on the nerve trunk of whatever character (freeing from adhesions, neurolysis, suture, etc.) demand the maintenance of perfect asepsis, and punctilious care and delicacy in the manipulation of the nerve itself.

THE MEDICAL SERVICE IN EVACUATION HOSPITALS

Chiefs of medical service should constantly bear in mind that the purpose of an evacuation hospital is to render temporary and emergency treatment only, and the real object of these institutions is to insure the safe evacuation of patients to still more favorable surroundings and facilities.

Cases requiring hospitalization for periods of over a few days should not be retained except in instances of military inactivity or when transfer to a more stable service would endanger life or hamper military purpose.

The medical work in evacuation hospitals then resolves itself chiefly into (1) speedy classification of patients; (2) immediate separation of contagious from all other and espe-

cially from the wounded and gassed; (3) administration of first-aid medical treatment; (4) the relief, even though merely palliative, of suffering and discomfort; and, finally, (5) the evacuation under favorable conditions of sick soldiers to hospitals designed for prolonged treatment are the other purposes of these hospitals.

Nontransportable medical cases such as acute pneumonias must, however, be retained for treatment until such time as they may be evacuated to other institutions with benefit and without danger to themselves.

Contagious cases such as scarlet fever, chronic ulcerative tuberculosis, and the like must be evacuated promptly as possible when this can be encompassed without undue danger to life. Cases of these types are particularly dangerous when retained in evacuation hospitals where the tide of cases is normally large and where slight lapses in anticontagious technique may be then followed by widespread infection.

The triage.—The triage medical officer must be selected with great care. He must be a man of high professional training, of decision of character, and one with a full appreciation of the military necessities of the occasion as well as the humanitarian requirements of the work. He must possess speed.

In the triage every nonsurgical case should be considered as contagious, and so handled until the contrary has been shown to be the case. Immediate separation of medical and gassed cases from surgical should be made at the ambulance, and these two grand types should never subsequently come into infection-bearing range of each other. Proper triage at the field hospitals should prevent the transportation of medical with surgical cases except in dire necessity, when masking greatly diminishes the likelihood of infection.

Where both medical and surgical cases must be handled in the same pavilion, all medical cases should be promptly masked and a cubical system established by means of which the unclassified medical cases are prevented from transferring infection to each other or the surgical cases.

Where possible, triage should be well lighted. This is very largely dependent, however, on military circumstances, as in bombing zones, etc. When possible it should be sufficiently ventilated and not overcrowded.

A very high percentage of medical cases entering the triage are suffering in greater or lesser degree from exhaustion, often combined with exposure and malnourishment. Two methods of treatment should be therefore automatically provided for and applied in all suitable cases. Hot nourishing or stimulating drinks, such as soup, cocoa, or coffee must be available at all hours, and external heat must be applied, best by providing a warm room for triage and warm and dry blankets in abundance. Undue exposure of the body for diagnosis should not be permitted in the triage unless sufficient heat is thus attainable. The use of hot-water bags, canteens, or of electric pads may be applied when isolated cases only are in need of treatment. One or more shock beds should be prepared and one should always be functioning during military activity.

As soon as possible (the proper conditions existing) the patient should be stripped and the body, especially the skin and mucosæ, searched for evidences of the exanthemata or of other contagious conditions or of infection. A hasty examination of the heart and lungs should then be made before further investigations or transfers are made.

Contraindicating conditions such as dilated heart or a pneumonia not existing, the soldier should then be bathed, clothed in dry and warmed blankets, and placed in the appropriate ward. Too much time must not be wasted in the preliminary examination; gentleness and celerity of handling are therapeutic agents of great importance in most cases recently from the battle field.

Conscientious salvage and filing of personal effects should be made, and personal articles of clothing preserved when practicable. Wanton destruction of property should not be permitted, but the soldiers' best interests must in all cases be first considered in this respect.

The wards.—All cases of doubtful nature should be sent to an observation ward in which screening and masking, together with other general anticontagious methods, are in vogue.

All contagious, including influenzas, pneumonias, and idiopathic catarrhal conditions, should be placed in screened cubicles, and ambulatory cases must be masked so that crossing of infections is impossible. It must be remembered that nearly all battle field contagions are transmitted through respiratory channels. Screening and masking will prevent them.

Stools, urine, and all other excreta must be disposed of as though definitely infectious until shown to be otherwise, and cleanliness in this respect is always imperative.

All cases except those obviously not seriously ill should be placed in bed and on a liquid diet of which the staples should be soups, milk, eggs when obtainable, cocoa, chocolate, coffee, and tea, to which may be added jam and bread when not contraindicated. An abundant supply of water must be provided.

The wards should be made as comfortable in all respects as circumstances permit. A dry floor is particularly desirable. They should afford sufficient air space for each case, and a certain degree of elasticity in this respect should be preserved for times of great activity or of delayed evacuation. While wards should be properly heated with Sibley stoves or by other methods, heating should not be encompassed at the expense of ventilation. All wards should be so arranged that they may be quickly cubicled by screening whenever necessary circumstances arise. All cases presenting catarrhal symptoms or diarrhea should be cubicled.

Medical officers on duty with medical cases in evacuation hospitals must constantly bear in mind that, while celerity in diagnosis is imperative and while instruments of precision are rarely available, accuracy of diagnosis within reasonable limitations is expected and imperative. The same general observations in regard to therapeutic measures also applies.

Evacuation.—All except nontransportable cases must be evacuated as soon as possible, awaiting only available transportation. Every anticontagious precaution noted in regard to the triage must be applied in the evacuation of patients before, during, and after loading.

Each case marked for evacuation must be plainly so indicated by the ward surgeon and must be seen by a competent medical officer not over one hour before the case is loaded. Chiefs of service will be held responsible for all failures to properly observe this order. No case with temperature of 100° F. or over may be evacuated sitting; and lying only when the case has been marked for evacuation by the medical chief of service.

Cases for evacuation lying must not be removed from their beds until the train for their transmission is ready to receive them. Exposure is particularly dangerous for these cases, and it must not take place unduly.

Medical officers must assure themselves that cases for transportation before loading are suitably clothed, that the supply of blankets is adequate and properly distributed. Ward officers will be held responsible, by the medical chief, for timely report as to special requirements in the way of food, medication, or other special care required by cases to be evacuated. The proper heating of the train should also be investigated by the evacuation officer. During loading the evacuation officer should assure himself that proper observance of anticontagious regulations are considered. Lapses from these rules are to be tolerated only under instances of urgent military necessity.

Four points must be constantly borne in mind by officers working in the medical service of evacuation hospitals.

First. The evacuation hospital is, first, a military institution and, second, a hospital. Its prime purpose is to free the dressing stations and field hospitals of the sick and wounded so that they do not constitute a military incumbrance.

Second. The second function of the medical service of the evacuation hospital is to minimize or prevent the spread of contagious diseases among the sick and wounded.

Third. The individual soldier must receive in the evacuation hospital every consideration and medical attention which circumstances permit. No facility at the command of the hospital is to be denied or limited in this respect which does not definitely encroach on the effectiveness of the principles stated in the first two articles.

Fourth. To prepare patients for evacuation to the rear as rapidly as is possible.

(h) *Mess.*—Extensive menus and elaborate preparations for furnishing special diets are impracticable and unnecessary in these hospitals.

Large quantities of hot nourishing liquids upon short notice are essential. Facilities for the preparation of stews, cocoa, and coffee, with bread and jam, should be at hand. A nourishing stew is perhaps the most important of all, as it will furnish at once either a liquid or solid diet, as may be required. The equipment for cooking should, in the main, be collected in a central kitchen. This equipment can be augmented from time to time by the addition of

wheeled kitchens, which besides augmenting the cooking facilities render the serving of hot food to distant wards possible and practicable, as the kitchen may be wheeled to the door of the ward. There should be a soup, cocoa, and coffee station in the receiving ward and triage section, where these articles of hot liquid food so necessary to the cold, exhausted, and hungry may be served under careful supervision of an officer, nurse, or intelligent aid. This work was done very acceptably by members of the Smith College unit in several hospitals of the First Army area. When it is considered that a vast majority of cases treated are retained in hospital not longer than 36 hours, it will be seen that extensive menus are impracticable and unnecessary.

II. REGULATIONS

Until the functions of evacuation and mobile hospitals are more definitely expressed in order, uniform sets of regulations can not be written for their internal administration. A set of regulations when written would of necessity have to be general or broad in its specifications. Details should not be covered, for the reason that some features of the work are performed differently in the various Army areas. If, however, each evacuation and mobile hospital could be furnished a standard set of so-called "general regulations," and upon its arrival in an army, corps, or division area another set of army corps or division "special regulations," the matter of regulations would be satisfactorily covered. The greatest difficulty has been experienced in obtaining general and special orders with circulars and memoranda. Where they had been sent to the hospitals there was no assurance that they would or had arrived. The question of reports, returns, and proper performance of certain duties in the hospitals was therefore in an uncertain state at all times. It appears necessary, therefore, that some special means be taken to assure the proper collection of data covering the points of special regulation, and it is suggested that this be done in the office of the chief surgeon of the army. An officer of experience should be detailed to perform this work and to see that the various requirements regarding reports, records, returns, and methods of administration are noted and up to date. The need of such a department as is here suggested is very apparent to one who has had an opportunity to discuss with commanding officers and adjutants the subject referred to. Newly organized hospitals, and in some cases hospitals which had been organized for some time, were constantly in doubt as to the proper method of procedure in some of their most important functions. A case in point was frequently referred, namely, burials. The regulations for this very important function are found in various orders scattered throughout the regulations of the American Expeditionary Forces, modified, rescinded, specified, and circularized. In order that the argument may be set forth more clearly, we may suppose that the officer detailed on "administration" in the chief surgeon's office had collected in one circular the current regulations, stated simply and accurately, ready for issue to organizations coming into the area, and that upon arrival he would personally visit the commanding officer and with the adjutant hold a conference in which he would turn over and explain the latest regulations covering proper function of the hospital.

Herewith is shown a sample set of "general regulations" for the administration of one of the evacuation hospitals.

EVACUATION HOSPITAL No 10,
AMERICAN EXPEDITIONARY FORCES,
October 8, 1918.

A. ORGANIZATION OF HOSPITAL

1. The following offices are established, which will report to the commanding officer direct: Adjutant, chief of service, registrar, quartermaster, admitting officer, evacuating officer, mess, sanitation, regulating officer.

2. The adjutant will act as commanding officer of the detachment, Medical Department, and will be charged with rendering all reports of the organization, with correspondence, and with the preparation and transmission of orders from the office of the commanding officer.

3. The chief of service is charged with the care of all professional activities of the hospital. He will exercise control over the sorting of patients, the preparation for operation of the operating rooms, the X-ray rooms, and wards. Officers in charge of medical service, all ward officers, and laboratory are also under his charge.

4. The registrar is charged with the preparation and care of all records of patients. He will turn in to the office of the adjutant all statistical and other reports called for from his office.

5. The quartermaster is charged with the requisitioning, securing, and storing of all supplies of the hospital, with the management of the laundry and the motor transportation assigned, and with salvage.

6. The admitting officer is charged with the admission of patients from hospital. He will be notified from the office of the adjutant when trains will arrive and what patients will be evacuated. He will see that wards are promptly evacuated and trains loaded and rationed, making report of evacuation to the adjutant's office upon completion.

7. The mess officer is charged with the management of all messes. Mess sergeants are under his direct control, and he will prepare menus and see to the proper preparation and serving of food throughout the hospital. He will secure supplies from the quartermaster.

8. The sanitary officer will supervise the sanitation of all buildings and grounds, and is in charge of outside police.

9. The regulating officer will act in the capacity of liaison officer throughout the hospital. He is particularly charged with the proper regulation and movement of sick or wounded from point to point in their progress through the hospital. He will make frequent inspections and insure himself that duties are properly performed, and see that the proper distribution of enlisted men for necessary duties is made. All litter bearers and unassigned are placed under his charge.

B. ADMISSION OF PATIENTS

1. Patients will be admitted to the hospital at the door marked "Bureau des Entres." They will be seen at once by the admitting officer. All cases which have not received A. T. S. will have same administered at once.

2. While waiting for records and sorting, patients will be deposited in the receiving area in the following order:

All prone cases in the first large room; sitting cases in the same room as far as accommodations permit. When the space becomes overcrowded, sitting patients will be admitted to the small room marked "Hospitalization," the overflow being accommodated in the large room behind.

3. Patients will be sorted and assigned to wards by the admitting officer. All cases requiring hospitalization will be assigned to the numbered wards. All officers will be assigned to ward No. 7. Cases in shock will be sent at once to the shock ward. Hospitalized cases will be delivered to the dressing room in front of south operating area, the overflow being placed in the rear end of south reception room. All cases which will be fit for evacuation after operation or other immediate treatment will be assigned to the lettered wards, filling the wards in order from east to west. Gassed cases and medical cases will be assigned to ward G. Walking wounded will be sent at once to wards assigned; others will be delivered to the dressing room in advance of north operating area.

4. The admitting officer is also charged with the care of patients' valuables. He will inquire of each patient as to his desire to deposit valuables and will insist upon taking valuables of all patients who are to undergo operation. He will keep a record of valuables in a duplicating book, delivering a signed original to the patient. Upon notification of evacuation he will deliver to the patient the valuables and secure his signature on the duplicate in the book.

5. In order that record of assignment be properly kept, the admitting officer will keep a sheet showing at all times the vacant beds in each ward. This sheet will be balanced and a new sheet prepared on each change of tour. Debit will be entered for each case assigned and credit entered for each case leaving the ward. In case the operating surgeon desires reassignment, the surgeon will be notified as to which ward patient has been reassigned, and the proper entry will be made on the assignment sheet.

6. When the space allotted for reception is full or in danger of overflowing, the regulating officer will be notified at once in order that admission to hospital may be stopped.

C. EVACUABLE OPERATING AREA

1. This area will extend from door of admission room in the north operating area to exit door toward evacuation wards. An officer will be constantly on duty in the area and will be charged with the examination of all patients admitted therein, the determination of need of operation, movement of patients through the area to X ray, operation and wards, general discipline and police of the dressing room, hallways, and preoperative space.

2. An officer will be detailed to superintend the preparation for operation and dressings, under charge of the officer of the area. Upon admission to this area, patients will be examined at once, dressings removed, and such cases as require operation prepared for operation, taken to X ray, to operation, and to the ward assigned in proper order. Where it is necessary to change the ward assignment the officer in charge of the area will notify the receiving officer and secure the reassignment. Patients requiring dressings only will be dressed and moved at once to their assigned wards.

3. When cases are being admitted too rapidly to permit the proper cleaning out of this area, selected cases awaiting operation will be sent to the tent area, after consultation with the regulating officer. A constant liaison will be necessary in this event to assure that these cases are operated before those of like character admitted at a later hour. It often becomes necessary to send this type of cases by train to operating hospitals at the base, and therefore becomes that every case passed through the dressing room to await operation should be prepared to go without for a period of 12 hours.

D. NONEVACUABLE OPERATING AREA

1. An officer, designated as a nonevacuable triage officer, will be detailed in charge of all the area from the receiving rooms to the exit from his area. This includes dressing room, X-ray room, and preoperative room. His duties are to see to the preparation of patients for operation, care for the orderly flow of patients through the area, secure assignments to wards when necessary, and to maintain discipline and proper police of the entire area.

2. Under his orders are placed the nurses and enlisted men on duty in the dressing room, and the litter bearers of his area.

3. Upon admission to his area, patient will be examined by the triage officer, and prepared for operation under his direction. They will then be sent to X ray, to preoperative room, and to operation in order. Upon completion of operation they will be sent to wards designated.

E. WARDS

1. Officers assigned to duty in wards are held responsible for the care and treatment of all patients under their charge, discipline of personnel attached for duty, and rigid police of their respective areas. They will be present for duty, or within easy call of their wards, at all times during their tour. Upon admission, patients will be assigned to beds by the nurse in charge, and the ward surgeon notified. A record will at once be made on the ward list of the patient's name, and will be checked in the proper column. A clinical history will be started in all numbered wards, showing patient's name and hour and date of admission. This clinical history is designed as a running commentary of the patient's condition while in the hospital, the orders of the surgeon's report of consultation, dressings, and other treatment.

2. As soon as practicable after admission the surgeon will visit patients. He will examine the patient's records, assure himself that field medical card, or its substitute, is in evidence and complete, special attention being given to the notes of surgical operations and X-ray findings. He will also assure himself that the personal possessions of the patient, other than valuables, are with the patient. All cases in the wards will be dressed under supervision of the ward surgeon. He will dictate the treatment and note same on the clinical record.

3. Where nurses are assigned to wards they are placed in charge under the ward surgeon. They will be held responsible for the condition of ward lists and the history of patients, for care of the patients under direction of the ward surgeon, and for the discipline of enlisted men. It must be understood that although the ward personnel is not responsible for the police of surrounding areas, they are forbidden to soil these areas or to deposit refuse or slop except in authorized containers. Wards will be kept in an orderly manner at all times, and surplus equipment will not be kept in wards but will be turned in to the quartermaster.

F. EVACUATING

1. Evacuators are placed in charge of the evacuation officer. He will be informed of the arrival of trains, the number of cases in each class to be loaded, the number of rations to be placed on the train, the hour of departure, and destination.

2. From the evacuation reports he will determine which wards are to be evacuated, aiming to evacuate wards in toto where practical. Evacuatable cases from the hospital area will always be evacuated when possible. He will inform ward surgeons of the hour when patients will be loaded for evacuation. These latter are charged with the preparation of the patients for evacuation at the time set. The evacuating officer will secure loading detail sufficient to load the train within the time limit from the regulating officer, who will see that detail reports at the appointed place at the designated time under a noncommissioned officer. He will also notify the mess sergeant if rations are to be placed on train, giving the number of rations and the time when they will be called for. He will attend in person to the orderly loading of the train, and assure himself that the work is progressing satisfactorily and in an orderly manner.

3. Ward surgeons will select cases for evacuation from the ward lists, always aiming to send out patients which have been longest in the wards. He will also notify the receiving office of the fact that patients are to be evacuated, in order that valuables may be returned before evacuation.

4. Evacuation by ambulance will be conducted in a similar manner.

5. The evacuating officer will have prepared a list of patients evacuated, showing whether sitting or prone; making separate lists for Americans, other allied patients, and for German prisoners. These lists will be turned into the registrar at once upon completion of evacuation, giving also the number of train, date and hour of departure, and destination. He will keep a record of evacuations, showing destination and number of patients evacuated.

6. It will also be the duty of the evacuating officer to load trains with patients from other hospitals when so directed. He will secure sufficient details for this work in the usual way, keeping report of train, number of patients, etc., as above.

7. Upon completion of any evacuation, the evacuating officer will at once report to the officer in charge of evacuations at Fleury.

G. REGULATING OFFICER

1. The regulating officer will act as a coordinating officer for all activities at the hospital. His duties will carry him to each department and he will see that patients proceed through the hospital in proper order, that supplies are properly requisitioned and issued, that an orderly appearance of the hospital be maintained, that all departments cooperate with the policing details in keeping buildings and grounds clean, and that there is a proper distribution of the enlisted force for the work necessary.

2. In his charge are placed the unassigned enlisted men and all litter bearers, who will be assigned to duty at such places and in such numbers as may be required. He is authorized to commandeer such men as are not actively engaged to fill any emergency. These latter, will, however, be relieved at once upon need for their services in their proper department, where emergency arises, in which sufficient personnel to meet the need is not present for duty. He is authorized to call on men who are off duty for detail. In this latter event, men will be called in accordance with a roster to be kept by the first sergeant.

3. In addition to the above duties, the regulating officer will act as fire marshal, and will see that proper provisions for control of fire are made and that the personnel are instructed in the use of the apparatus provided. He will detail sufficient men to man the fire apparatus from the litter bearers, and instruct them in their duties in case of fire.

4. He will perform in addition the usual duties of the officer of the day.

H. WARD RECORD FOR THE EVACUATION OF PATIENTS

Name	Regiment	Nonevacuable			Evacuable					
		Surgical	Gassed	Medical	Surgical		Gas		Medical	
					Sitting	Prone	Sitting	Prone	Sitting	Prone
Jones, John.....	22d Cavalry.....									

1. Above form to be kept current in each ward. An admission nurse puts name and organization in proper place. Check mark is placed in appropriate place as "Nonevacuable, surgical." If class changes, put ring around check, and check in new column as "Evacuable, surgical, prone." If status changes, proceed as before, checking new space as "Evacuable, surgical, sitting."

2. When case is evacuated, the evacuating officer will cross off name after taking it down on his list.

3. This enables evacuating officer to tell at a glance how many cases of each class are present in the ward, and also permits him to check out cases for evacuation.

I. REPORT OF EVACUATIONS

1. The following report will be rendered at 6 a. m. and 6 p. m., using the form as written below.

2. This report will be made for each of the following classes of cases: American, French, Italian, English, German officers, and other German prisoners. If any of these classes are not in evidence, report may be omitted in that class.

3. Report should reach this office not later than 7 o'clock. This report may be called for at any other time.

EVACUATION HOSPITAL No. 10,
September 30, 1918—6 a. m.

	Nonevacuable	Evacuable	
		Sitting	Prone
Preoperative wounded.....	25	110	62
Other surgical.....	15	5	7
Gassed.....	2	0	0
Medical.....	20	251	101
Total.....	62	366	170

By order of Colonel BAKER:

(Signed) F. J. GOSIN,
First Lieutenant, M. C. Adjutant.

Another very handy arrangement is a so-called adjutant's check list of reports and returns. It is this list that the officer in the chief surgeon's office should keep up to date in each hospital. As kept up to date by the adjutant of evacuation Hospital No. 6, it was a constant source of information for commanding officers and adjutants ordered into the area of the First Army.

III. FUNCTION OF MOBILE AND EVACUATION HOSPITALS

The evacuation hospital was known to us almost entirely in theory before our entrance into the present war. The mobile hospital, in as far as our Army is concerned, is a development of the present war.

(a) The evacuation hospital with which we entered the war has developed into an entirely different institution than that described in the Manual for the Medical Department; or, it may be said more properly, the requirements of the evacuation hospital now demanded by our Army

have gone far beyond the provisions made in the manual for such hospitals. What it is at present, however, we find expressed in some 20 hospitals, termed evacuation hospitals, no two of which are alike in appearance or function. This development and present state are a result of their having had to meet urgent necessity wherever and whenever found, under circumstances new and peculiar to us as well as to the French and British, namely, the conditions of a rapid advance, which had not occurred prior to our entry into the war. The situation met by the Medical Department of the United States Army was just as new to the French and English and found them relatively as poorly prepared to meet the condition as it found our Medical Department. The loss of thousands of beds, valuable equipment, and personnel by the English and by the French from March 21 to July is a decidedly pointed argument and must be met for the mobile and evacuation hospital if they are to be made effective and satisfactory. It is possible that the situations which did develop were impossible to foresee. It seems, however, reasonable to suppose that army hospitals should be prepared for sufficiently rapid movement to prevent capture and to follow and advance, no matter how rapid. With the provision of proper transportation and the service of sufficient engineer and labor troops mobility can be had. It may be thought by some that mobility is impossible. It certainly is not impossible and is not impracticable. It is furthermore essential. For the realization of this essential feature we depend solely upon a definite presentation of the problem, with a demand that regulations and organization furnish the necessary facilities. If these are not furnished, the question ceases to be a medical problem and becomes a military condition imposed upon the Medical Department by competent military authority for sufficient reason and with full realization and responsibility for inconvenience, suffering, death, and loss of equipment and personnel.

The problems met by our evacuation and mobile hospitals varied with certain well-known conditions found to exist in the army areas.

(1) With fixed trench warfare in easily defended areas the hospital usually became fixed. Buildings were adapted or constructed for hospitalization. Facilities were usually at hand for good work and the hospital tended to become anything but mobile. Many of the evacuation hospitals had no rail facilities for the reason that desirable buildings had been occupied at a distance from a railroad, and spurs had either not been demanded or had been refused. This hospital was not an evacuation hospital, neither was it a mobile hospital, and it approached more nearly the function of the base hospital. The essential features of rapid admission of large numbers of patients, with facility in triage and transmission to large evacuation areas located on a sanitary siding, were usually not available as the function of the hospital had necessarily been adapted to the facilities found to exist. As none of the civil or barrack buildings found in an army area were built with the idea that they would at some time be occupied by evacuation hospitals, it was not surprising that they were not found adaptable to the essential functions of these hospitals.

(2) Another type of hospital has developed under somewhat similar circumstances to that mentioned under the first heading. The hospital in many instances so developed has been admirably built and equipped to meet the problem which existed at the time of construction. The problem was the receiving, operation, and leisurely care of perhaps 5 or 6 cases a day, or, with a great and sudden rush, 35 or 40 cases. There being no particular demand upon bed space, cases were usually given complete treatment. It was, therefore, not an evacuation hospital. These hospitals were frequently specialized, some taking only gas, others head cases, some contagious diseases, and in some instances various and sundry medical and surgical specialities. With the problem these hospitals were expected to meet, in a relatively leisurely and businesslike warfare, where mutual agreements existed that shots would, or would not be fired during lunch hour, or on various special and national holidays, or at certain areas, crossroads, etc., there was no need for the evacuation hospital as we see it now, or as it was demanded when mobile warfare commenced in fact. It was hospitals similar to these that were captured with large amounts of valuable and almost unobtainable equipment.

(3) The third type of hospital, termed an evacuation hospital and which as a matter of fact was very nearly in principle an evacuation hospital, had its origin some time in June, and through successive actions, stations, difficult and well conducted "shows," passed through various stages of evolution, accumulation of property, and duties, to a stage of relative

perfection which bid fair to develop into the typical evacuation hospital suited to our purpose in this or any other war or campaign in France or elsewhere. This hospital has been known on repeated occasions to perform excellent service in two widely separated positions with a lapse of only a few hours in function. In one instance Evacuation Hospital No. 5 evacuated its patients, dismantled its establishment, packed, was transported, set up its essential department, and received cases in slightly over 36 hours. The task was accomplished in spite of various handicaps which can and should be eliminated. This hospital had in its equipment a few Bessonneau tents, a few camions, a mobile laundry, and trucks, all or most of which were poorly adapted to mobility and the source of unending labor, exasperation, and inefficiency. In a move of some 35 or 40 kilometers this so-called mobile equipment was almost wrecked, requiring the greater part of three days in its transportation. Wheels which were never intended for anything but support and were never meant to be used in transportation, developed hot boxes, came off, and caved in. The commanding officer, who should have been free to travel up and down the line of march regulating, arranging, and informing himself as to the progress of the march, rode in a truck and depended for his information upon reports which reached him on or about two days after he had arrived at his new station, which reports usually consisted of details concerning a truck which had broken down, or information regarding the location of a wrecked camion or laundry. His truck transportation was inadequate and of the cast-off, crippled type. In need of supplies and rations, he was dependent upon requisitions which had to pass through division channels and usually resulted in nothing but confusion. The balance of the equipment of this hospital consisted of what the commanding officer, his supply officer, his surgical chief, and others had made it by dint of persistency. There were three other hospitals which in a way resembled the hospital just described. Their equipment, methods, regulations, and personnel were anything but standard except in the particular that they were invariably incomplete.

(b) Mobile hospitals were more fortunate in the matter of standard equipment. Most of them were in fact "mobile," and performed indispensable service in relieving the evacuation hospitals of the heavy surgery and in taking the serious cases relatively near the firing line. They were greatly handicapped by lack of transportation when needed for rapid moves. In fact, these hospitals have been known to move on transportation procured by the commanding officers from various sources, through devious channels, and entirely as a result of forceful and tactful management on the part of the commanding officer. They functioned in this respect in spite of adverse circumstances and not as a result of facilities at hand. Their mobile equipment was often in trouble on account of imperfect adaption to the requirements placed upon it.

IV. STANDARD TYPES OF MOBILE AND EVACUATION HOSPITALS

1. Mobile hospitals are essential in the army area. They should be so standardized in equipment and function as to allow of their efficient function at the rate of one hospital per division in time of attack or activity. In quiet times one mobile hospital can care for the wounded of two divisions with certain organization to be mentioned later. It is believed that this rate, or proportion, of establishment troops in the line will be efficiently served. As stated, the parent or main portion of the organization should be established close up to normal artillery fire. Each hospital should have what might be termed an "advance section," consisting of 1 or 2 Bessonneau tents with facilities for handling from 2 to 6 operating tables, this to include teams, an administrative officer, and soldiers as anesthetist and operating assistant, with a small clerical force. Nurses would have no assignment in this advance section. Upon call in case of necessity, this advance should be thrown forward to a dugout, a protected building, or favorable area for the pitching of tents, where they would be able to care for that hazy classification of the wounded, called "nontransportables." Their supply of instruments, sterile dressings, laundry, rations, and other essentials would be sent them from the parent organization by a system of automatic supply or replacement. This arrangement of an advance section could be made to cover the work now performed by the much discussed and in most cases unwelcome mobile operating unit, supplied divisions, and left by them in many instances along the road to be salvaged on account of lack of transportation, surgical teams, and other small essentials. In case of an advance of the line, the "advance

section" might well prepare the location for the gradual establishment of the parent organization about it. Function would thus be almost uninterrupted when another "advance section" or two could be sent forward to a more advanced station. Certain well-known changes are necessary in the mobile equipment, satisfactory arrangement of which can be accomplished by the commanding officers of experience, who only await an opportunity to recommend and carry out changes which will make this hospital a truly mobile and effective organization. It has been the object of this paper so far to cover points of administration, function, and organization, which apply equally to mobile and evacuation hospitals. The specifications mentioned, as necessary for mobile hospitals in particular, are few, as the organization now existing is believed to be very nearly satisfactory.

2. *Evacuation hospitals.*—The function of a typical evacuation hospital should be decided upon and expressed concisely in orders. The points considered essential are: (a) Its location on a standard-gauge railway with adequate ambulance roads from the front, draining the required sector. (b) A sanitary siding of between 1,400 and 1,600 feet, with a loading platform, and ambulance roads within the area to be occupied by the hospital as shown in plan attached. (c) A water system piped as shown in plan. (d) Standard equipment, consisting of equipment A, of 500 beds; equipment B, which added to equipment A will give accommodation to 1,500 patients; equipment C, which added to equipment A and equipment B will give accommodation for 3,000 patients. For each army there should be an army hospital group for the supply of equipments A, B, and C, which equipments would consist of the specified number and types of tents, teams, officers, nurses, soldiers, labor troops, transportation and hospital equipment. With this understanding and with these facilities the hospitalization of an army area would become simple, and could be done quickly and accurately with assurance that the area of the army, in so far as the care of the wounded and sick is concerned, would be handled very efficiently.

Some of the reasons for the specifications necessary in evacuation hospitals may be stated in detail as follows: Standard-gauge railways in areas operated by American officers were rapidly constructed and kept well up in the army area. From information regarding future plans for railways, it is reasonably certain that in any future war they will be in a position for use as far as location and availability are concerned, as an army can not well go ahead of its supply. By consultation with the railway engineers, prospective construction into new areas can be determined; and by timely request, sidings can be had in favorable locations with the minimum effort, while the labor, materials, and special personnel are on the ground. It is certain that with definite plans, blue prints, and specified statements regarding our needs, the Medical Department can get what is required in the matter of railway accommodations and sidings. An indefinite request for a siding made after the railway engineers have been moved to another area will result in little more than the detail of an officer to make estimates and plans, which may be reported upon after some delay. If the chief surgeon presented this plan to G-4, with blue prints which can be made to fit any situation, with a request that this work be done while materials and personnel are at hand, the work would be accomplished. A hospital acting as an evacuation hospital located beyond practicable litter carriage to a loading platform should not be considered an evacuation hospital, and should be avoided, as this hospital requires additional handling of patients and an amount of ambulance transportation which exactly equals the amount and number of ambulance loads required to bring the patients to the hospital. Location on the railway reduced by this much the number of ambulances required for an army, and it is presumed that ambulances will always be difficult to obtain; that is an important consideration. Where the hospital is not located on a railway with a sanitary siding, the evacuation time of the area is increased by the time required to load and unload the ambulances, transport the patients over roads which may result in injury to the patient, all of which may require from one to three hours of time, during which time the patient may be subjected to cold, rain, injury, inconvenience, lack of toilet facilities, and even danger to life as a result of being out of touch with nursing and surgical assistance. This method of evacuation also requires the introduction of complicating features which is entirely unnecessary; i. e., the feeding and housing of the loading platform which means practically the duplication of the evacuation force and equipment already in existence at the hospital from which they are being evacuated. In the absence of these entraining facilities at the hospital, patients have been known to lie

out on platforms in inclement weather for hours. In one instance some 300 patients were returned to the hospital which was attempting to evacuate them, with the result that the patients were in ambulances on dark roads most of the night. This unfortunate state of affairs being the result of the nonappearance of the hospital train. It is reasonable to suppose that hospital trains will frequently arrive after the hour at which they were intended to arrive, so that unless the evacuation wards are along the loading platforms where loading may be commenced when the train actually appears, inconvenience, to say nothing of suffering, will result. Under the heading (b) of essential features in the evacuation hospital, ambulance roads in the area of the hospital were mentioned. These roads were shown in the ground plan.

Arranged in the manner shown, admission, distribution, supply, and evacuation may be accomplished with efficiency. The difference between an evacuation rate of 2 patients per minute and 1 patient in 5 minutes is largely one of roads, walks, and favorable location of evacuation wards. Here also the construction and procurement of this vital feature depends largely upon knowing what we require and upon our ability to turn over to G-4 and the Engineer Corps a well-made blue print which can be at hand and made to apply to any location we may find ourselves in.

(c) Water will, in the majority of instances, be found near the railhead and can be piped to a supply tank from which distributing pipes can be placed, as shown in ground plan. If water is not available at railheads, it can be supplied to the hospital by railway tank cars. Here again a definite statement of the number of gallons required in 24 hours, whether to be chlorinated or not, and the blueprint showing the distribution, will facilitate the obtaining of a water system. Two water carts should be supplied for equipment A, 3 for equipments A and B, and 4 for equipments, A, B, and C. Equipment proposed under (d) will not be defined, as it is believed that the details or tables should be the result of recommendation by a board composed of commanding officers, professional chiefs, and supply officers who have had experience in these hospitals. The general plan, however, of a standard unit equipment for 500 beds which could be raised without confusion, as the conditions required, to 1,500 and then to 3,000 beds, is proposed. With the ground plans shown herewith, an A or unit equipment could be sent by rail to a siding, unloaded, and put up. The administrative personnel for this hospital, or for anything it might consequently become, would therefore be at hand. As the situation developed, and upon demand, equipments B and C could likewise be sent by rail, unloaded, and placed around the unit equipment as shown in layout plan. With facilities similar in a way to those herein recommended, an organization fresh from the United States developed and expanded from what they had expected to be called upon to perform into a hospital which hospitalized on one occasion 2,190 cases and evacuated by train faster than trains could be supplied. Should retreat be necessary, this hospital with its equipment and patients could be moved by rail very rapidly. With an advance of the line a new type "A" equipment from the army hospital center could be "leap-frogged" to the new position and the "B" and "C" equipment of the old location could be packed and transported by rail when required.

Equipment for the standard evacuation hospital will have to be greatly modified, as our present conception of what this equipment should be is lacking in many respects. Kitchen equipment in particular needs attention. Heavy ranges are impracticable and unnecessary. There should be adequate boiler equipment similar to that used in some of the French hospitals, which can be set on tripods or upon extemporized bases of stone or brick. It is believed that a board should be appointed for the purpose of standardizing kitchen equipment and that they should be particularly instructed to make this equipment light and compact for transportation and that the main use to which this equipment will be put will be in the preparation of stews, soups, and liquid diets.

Laundry equipment has been unsatisfactory. Several excellent suggestions have been made by commanding officers and others regarding essential and necessary changes. It is believed that the laundry equipment should contain a large and effective dryer, as much time has been lost in drying linen and it has frequently been sent to the storeroom in a damp condition. Several excellent suggestions have been made regarding dryers. It is believed that the dryer of an evacuation hospital should be mounted on railway cars for the purpose of

quick transportation, by which method these laundries could be transported without damage, which has invariably occurred when they have been sent over roads. It is believed that an evacuation hospital with an adequate laundry plant manned by trained personnel could do the work required of the mobile hospitals of the area. A certain number of mobile laundries should be available, however, and a practicable mobile plant can be very easily designed which will travel readily, under its own power, over ordinary roads. This can not be said of the present French mobile laundry.

Truck transportation, though essential for evacuation hospitals, would be much less necessary if these hospital were located on a railway near railhead, as supplies could be furnished on the hospital siding and unloaded from the cars into the storehouses or trucks for a short haul.

Wheeled litters for transportation of cases from ward toward or even to the unloading platform will save much labor and 50 per cent of the number of litter bearers required for the ordinary litter. Large supplies of duckboards for walks should be at hand and a standard equipment of duckboard should be furnished with each type of hospital.

Ambulance tracks made of 2 by 12 inch timbers, with side guards constructed in sections, or Decauville or 60 cm. track may be used in some of the less traveled roads. These tracks can be used especially about mobile hospitals. An ambulance road can be constructed with these tracks in a few hours.

Illuminated signs marking the hospital, the receiving ward, office, and various departments are easily constructed of boxes, with signs of translucent material.

V. GROUND PLANS

Standard ground plans for the typical evacuation hospitals will depend particularly upon the type of tent used. It is believed that the most satisfactory tent for all service is the Bessonneau tent. The small tent measures about $19\frac{1}{2}$ by $58\frac{1}{2}$ feet. One of the hangar tents measures 65 by 84 feet. It is believed that the standard A type hospital should have at least 10 Bessonneau tents of the small type, arranged as shown in the drawing of ground plans. This number would suffice for receiving triage, shoe, and operating departments, with at least two which could be used for the more urgent type of hospitalized cases. The additional tentage might then, especially in favorable weather, be made up to 500 beds by the use of the present ward tent where it was desired that the hospital should be reduced to the minimum weight. It is believed, however, if we establish this hospital along a railway with a siding, the question of weight could be well ignored and that the entire equipment could be Bessonneau tents. With the addition of B and C equipment, a hangar tent should be erected over the receiving tent while it is in operation, as more room for receiving will be required than that which is available in the small Bessonneau tent. With the complete establishment of the Bessonneau hangar, including a ceiling about 12 feet high, the small Bessonneau tent should be dismantled and removed without interruption to receiving. Another large Bessonneau tent might well replace the two operating tents at the other end of the area, with central sterilizing facilities for instruments, dressings, and supplies. This tent should also have a ceiling, especially in winter for conservation of heat. The ceiling should be made of an opaque material to hide the light from aviators at night.

The ground plan furnished shows only distribution. Dimensions can be readily set in upon determination of the type of tent to that used, allowing 25 feet between tents laterally and 15 feet between ends. A canvas-covered frame should be constructed over the ambulance drive in front of the receiving ward for the protection of patients being unloaded. The arrangement of tents in the receiving, triage, and operating area provide for a continuous flow of patients to the wards and evacuation area, which reduces the litter carriage and confusion so often found in evacuation hospitals where a patient is littered back and forth throughout the area where tents have not been arranged with a view to continuous flow. A Bessonneau corridor, or an improvised corridor, might well be placed between two sets of tents in the rear of this area for the protection of patients from rain and cold and for use in case large numbers of patients accumulated in the preoperative area. At the end of this corridor is shown an X-ray equipment for slight and walking wounded cases. This would be in addition to the plant for severely wounded shown in the third row of tents. Communi-

cation could be had between the light and heavy operating tents and the sterilizing tent by means of short corridors, as a section of the side wall of each can be easily removed or turned outward for the side wall of the corridor.

Distribution of water plugs as shown in the drawing makes the establishment of one pipe line sufficient for distribution. There being no angles, this line could be quickly laid. A water tank erected near the siding could be filled from a general water supply or from tank cars brought in by rail.

The loading quay should be at least 14 feet wide and 1,000 feet long. It may be constructed of earth covered with gravel or cinders, by putting the siding in below grade and throwing the excavated earth to the hospital side, where it can be arranged in a gradual slope from the evacuation wards up to the usual car-door level. As evacuations would be made from the evacuation wards situated along the quay, litters could be placed directly upon the quay from the tent door and there loaded into the car. With classification of evacuation wards into medical, gas, surgical, walking, and sitting, arrangements could be made to load these special classes directly into cars placed opposite the wards. This will reduce the danger of contagion, especially where large numbers of grippe and contagious cases are being evacuated.

The laundry is shown mounted on a railroad car and is placed at the end of the sanitary siding where laundry could be delivered and sent out on the loading platform.

A lighting plant and a generating plant for X-ray use might likewise be mounted on a car.

A delousing and bathing equipment could be constructed with the use of railway cars and additional tents or knockdown buildings which could be set up near or around it.

Dimensions other than those given in ground plans are not possible without a decision as to what type of tent will be used. The type of ambulance road will depend largely on the soil and season. They should, however, be adequate to prevent miring as much as possible, as much valuable time has been lost by trucks and ambulances as a result of poor roads. Ambulance roads should be at least 14 feet wide.

A standard red cross made of material which will furnish a contrast for aerial picture should be constructed with the first sign of activity on the ground to be occupied by the hospital. This cross should be at least 100 feet in diameter. The width of the crossarm would therefore be $33\frac{1}{3}$ feet.

The table "Tents" is provided for tentage of the A, B, and C types and provides for (1) Bessonneau and hospital tents; (2) Bessonneau, ward, marquee, and hospital tents; and (3) aviation hangars and Bessonneau tents (small size). This table should be filled in when the tentage equipment has been decided upon by a board appointed for the purpose.

VI. ARMY HOSPITAL CENTERS

Hospitalization of any army area is a question which must necessarily come under the control of the chief surgeon.

In order that the chief surgeon may have at his disposal the essential elements for hospitalization, he should have in the army area a center of supply for equipment, personnel, and supplies.

Early in the Argonne-Meuse engagement, with some 30 hospitals established in the area of the First Army, it became evident that there was need for a replacement or supply center from which replacements and reinforcements of personnel and equipment could be furnished quickly and accurately. A center similar to the one proposed has been established for the assembling, equipment, and training of mobile hospitals.

In the area mentioned, teams, soldiers, nurses, and labor troops were overworked, tired out, and insufficient in number to meet the demands of the station. With rush work, preoperative evacuations were often found necessary where quick reinforcement or replacement of personnel would have made it unnecessary. Surgical teams and their personnel worked continuously for longer periods than the average human is intended to work rapidly and efficiently. The troops this personnel cared for were relieved and sent to rest and replacement areas when necessary.

With the formation of armies it is presumed that general training camps for the training and equipment of medical personnel will be formed in the Services of Supply. Here evacuation and mobile hospitals could be organized and trained with standard equipment. Administrative officers, especially, should be developed, as men of insufficient training and adaptability to hold responsible positions have been at fault in most instances where hospitals were found to be inefficient. From these Services of Supply training camps personnel as units or as replacements could be supplied to the army hospital centers located near the center of the army area, close up to the corps area. With the call for hospitalization of an army area, the chief surgeon would make requisition for a certain number of mobile and evacuation hospital organizations, which would be sent to the prospective hospital center area. With these hospital organizations it should be understood that a definite percentage of replacement personnel and equipment would be sent. A reserve of B and C type units of equipment would also be sent according to a table decided upon by the equipment board mentioned. A commanding officer of experience should be placed in command of this center and made responsible for the efficiency of organizations sent out when called for.

After a study of the area, prospective railway construction, future railheads, possibilities of the various elements of the action contemplated, roads, water supply, protected areas, etc., evacuation points and, therefore, evacuation hospital sites could be determined. The establishment of sidings, construction of roads, and installation of water supply could be commenced as soon as material and personnel become available, and certainly before these necessary elements had been removed from the area. After preparation of the area the necessary equipment could be sent by rail with the orderly and timely establishment of evacuation hospitals. Mobile hospitals should be established later to meet the specific needs with developments of the situation, there being less haste in the establishment of these hospitals, as less transportation and work is required to get them into operation.

Communication between the hospitals and the chief surgeon's office, "G-4 evacuation," the regulating officer, and the corps surgeon by telephone and a courier system which will function are absolutely essential to the proper conduct of hospitalization and evacuation from any army area. The chief surgeon's office should be constantly in touch with all the offices mentioned. If communication by telephone is not possible at all times, serious delay in evacuation will result, hospitals will become overcrowded, with resulting preoperative evacuation which might have been avoided.

A graphic chart, for use in the chief surgeon's office, is shown herewith (blue print). This chart shows at a glance the status of the various hospitals in the area, in so far as the number of officers, soldiers, nurses, patients, and the teams is concerned. It also shows the bed capacity in each hospital.

It is desired again to acknowledge the source of a large part of the material of this article and to state that the object of this paper has been to collect in one article the good features developed in the various hospitals and to attempt to explain and point out the reason for unsatisfactory function where it has been found to exist. It is desired particularly to acknowledge the valuable suggestions and notes of Colonel Garcia, of general headquarters; Colonel Brooks, of the chief surgeon's office, Second Army; Colonel Baker, Major Jamison, and Captain Blackburne, of Evacuation Hospital No. 6; Major Rice, of Evacuation Hospital No. 10; Colonel Flint, of Mobile Hospital No. 39; and the excellent examples set by the hospitals which did such splendid work under trying circumstances around Chateau-Thierry, Villers-Cotterets, and in the Argonne-Meuse activities.

Army Sanitary School No. 158.

DIVISIONAL MEDICAL CAMPS FOR THE TREATMENT OF VENEREAL DISEASE IN THE
AMERICAN EXPEDITIONARY FORCES

Maj. H. L. Sanford, Urologist, Second Army

REASONS FOR THEIR ESTABLISHMENT

The original policy proposed by the division of urology for the treatment of venereal disease in the American Expeditionary Forces contemplated the handling of cases as near the front as possible and, with their units, sending to base hospitals or other special urological hospitals which might be formed only such cases as could not properly be treated farther forward. It was hoped by this method to avoid certain results which followed the English and French system of sending all such cases to the rear, a system which involved additional transportation, prolonged the patient's period of ineffectiveness, and deprived organizations of the services of these men, often valuable, since they were sent to replacement camps after completion of their treatment.

DIVISIONAL CAMP, 1ST DIVISION

Although the system proposed for the American Expeditionary Forces proved both logical and practical for troops in rest or training areas, it was found to be unsatisfactory when the 1st Division went into the line. Organizations were split up into small units, the men got separated from their medical officers and from their medical records, so that those in charge of this work found they had no control of the situation and that patients suffered for lack of necessary care. The urologist of the 1st Division accordingly proposed and was authorized in March, 1918, to form a camp in which should be concentrated all cases of venereal disease in the division where they should receive uniform and intensive treatment and where the services of those physically able might be employed in the formation of working parties.

This camp, after being in successful operation for a few weeks, was broken up when the division left the area, and this organization subsequently changed its station so frequently and was constantly under such active fighting conditions that it was never subsequently possible to reassemble the camp for any length of time sufficient to get results in venereal treatment.

DIVISIONAL CAMP, 42D DIVISION

It was determined to try out this same plan in the 42d Division, at that time holding the quiet Baccarat sector, and in April, 1918, a camp of this sort was established in the divisional area. The following details are taken from our reports to the division surgeon on the camp at that time.

Location.—Outside of the ordinary considerations which govern the selection of a camp site, it was desirable that this camp be: (1) Centrally placed in the divisional area; (2) near projected work for which labor parties would be needed; (3) near enough the front line so as not to put a premium on acquiring venereal disease; and (4) provided with natural camouflage.

These points were covered by the selection of a wooded site near projected road improvement and halfway between headquarters and the trenches.

Officers, personnel, and equipment.—Officers: Three lieutenants from the Medical Corps were found necessary to run the camp properly—officers from the Medical Corps instead of line officers were intentionally chosen, as the latter might regard such an assignment with little enthusiasm. One lieutenant had general administrative control of the camp, and was selected with especial regard to his known ability to maintain a high standard of discipline; a second officer, who had had special training and experience in the treatment of venereal disease, had purely medical duties; a third officer was needed to act as relief for the other two.

Personnel: A detachment of 23 men from Field Hospital No. 167 was assigned to this work, consisting of the following ranks: 1 sergeant, first class; 1 sergeant, acting as mess and quartermaster sergeant; 1 sergeant in charge of infirmary; 1 sergeant, drill sergeant; 1 cook; 2 corporals; 8 privates, first class; 8 privates.

Equipment: The equipment was taken from Field Hospital No. 167 with the exception of the Bessonneau tent used for the infirmary. No wooded barracks were used, though they would be needed for a winter camp.

Plan of camp.—The tents for patients and personnel are regulation ward tents in field hospital equipment. Two large tarpaulin flies cover the kitchen and mess tables. The company office is located in a pyramidal tent, with two smaller tents for officers. All tent floors are made of a 3-inch layer of small stones.

Infirmary.—A Bessonneau tent 60 by 20, donated by the American Red Cross, contains the infirmary. The tent is divided into three sections by blanket partitions; the first is the infirmary proper, which has a board flooring. The rest of the tent has a gravel base.

In the infirmary all the furnishings, operating table, other tables, chairs, stools, supply shelves, and irrigating stand were made at the camp out of duck boarding or boxes from the sales commissary, and no little ingenuity was shown in their contrivance.

Two old coffee boilers with faucets were reclaimed from the salvage dump, and now make excellent containers for hot and cold sterile water, and the irrigating trough was lined with tin also obtained from the salvage dump.

The second section of the tent is used for sleeping quarters for the sergeant in charge of the infirmary and the third section for storage of patients' equipment, with a rack for rifles.

Patients.—During the six weeks this camp was in operation, before the division left the area, a total of 241 cases were treated.

The greatest number of patients at the camp on any one day was 182; the daily average was 167. These cases were classified as follows:

Venereal:

Chaneroid.....	3
Gonorrhea.....	145
Syphilis.....	60
	<hr/>
	208
	<hr/>

Nonvenereal:

Cystitis, cause undetermined.....	1
Hydrocele.....	2
Phimosis (for circumcision).....	13
Suspected syphilis.....	4
Urethritis (nonspecific).....	2
Varicocele.....	3
Venereal warts.....	8
	<hr/>
	33
	<hr/>
Total.....	241

Chancroid.—But three true cases were seen; most of the men admitted with that diagnosis proved to have syphilitic or mixed infections, as controlled by smears and Wassermann tests.

Gonorrhea.—The majority of cases were old relapsing cases in the chronic stage. Many developed symptoms following duty in the trenches, without opportunity for exposure. Many others were infected before enlistment, and it was often hard to differentiate between a relapse and new infection, as symptoms appeared atypically.

Syphilis.—Of the 60 cases, 35 were infected before enlistment, at dates running back as far as 1904. Some of these patients presented relapses after having been assured they had had adequate treatment for a cure. In other cases the diagnosis was made for the first time, as previous manifestations had not been recognized.

Of the 25 men infected in the Army, 16 had taken no prophylaxis whatever, while in 9 prophylaxis was for some reason inadequate.

Four cases at first suspected to be syphilis were removed from the list, after careful inquiry into the history, and repeated negative Wassermann tests, including provocative injections of Neoarsenobenzol.

Administrative.—Discipline: It was felt that a very high order of discipline should be maintained to handle successfully this type of case, and the camp was accordingly run as a military camp and not as a hospital. Men sent to the camp were detached from their organizations "for duty" at the camp and were not carried as "sick" unless actually sick in quarters. As a matter of fact, patients proved extremely amenable to the regulations prescribed and showed an excellent spirit.

An effort was made to raise the morale of these men by impressing on them two things—first, that they were being given the benefit of uniform and intensive treatment by men trained in that work and with the best type of equipment and medicines; second, that with a sufficient treatment they could be cured.

Employment: As one of the main objects of the camp was to form working parties from those patients physically able to work, the problem of classifying patients as to their fitness for labor required solution.

It was found that roughly one-quarter of the men could do no work at all, either from the intensive nature of the treatment they were taking or from disabling complications of their disease. A second quarter were able to do light work about camp, while something over half could go out for a day's work, taking treatment either before leaving camp, or on their return. This corresponded practically to acute, subacute, and chronic types of disease.

Working parties: Those able to do a day's work left camp at 7.30 a. m. and returned at 4.30 p. m. If the location of their work was a kilometer from camp, they walked to work and returned to camp for their midday meal. If the work was farther away, they were transported in the hospital trucks and took their mess with them, the trucks calling for them in the afternoon.

Details were chiefly employed in quarries in breaking stone and in road improvement, much of which was needed. One thousand six hundred and twenty three days work of eight hours each were sent out from camp.

Lectures and drills: The subacute type of case was the most difficult to handle. Though not able to work hard, these men were still much too active to be kept out of mischief by the small amount of work involved in guarding and policing the camp. Accordingly a schedule of lectures on personal hygiene, camp sanitation, and gas defense was made out and given. To this was added various drills, setting-up exercises, close-order drill, gas drill, litter drills, application of splints and bandages, and general simple first-aid work, given by a drill sergeant assigned for the purpose.

Odd jobs department: It was also suggested that a hospital tent be equipped with a carpenter's bench and a few metal-working tools in which patients able to do light work could do various odd jobs. It was proposed that the many signs needed in a divisional area could be made and lettered there, and we were assured that, if such a place was known to be available, many things would be turned over to us. We were promised the tools and equipment but a change of station prevented its being tried. It was also proposed that the rides and equipment of patients in the divisional hospitals could be sent to the camp to be cleaned to avoid deterioration. Some basket making was done by a patient who knew how, and who taught several others. It would be a question of determining some product for which there is a steady demand in a division, and which could be turned out satisfactorily by untrained labor, involving light work. This should only require the installation of inexpensive and easily transportable shop equipment.

Amusements: This type of patient needs a certain amount of amusement to avoid the mental depression often associated with venereal disease, and a day which furnishes only hard labor and sometimes painful treatment is not inspiring.

A Red Cross tent, with phonograph and writing material, is useful. A canteen is not necessary, and would only be an aggravation, as patients are generally under sentence depriving them of pay. Tobacco and other comforts were frequently distributed by the Red Cross, and a regimental band came each Sunday and gave the patients a much appreciated concert.

Medical treatment.—Infirmiry: The equipment of the infirmiry, which occupied a 60 by 20 Bessonneau tent, furnished by the Red Cross, was described in the first report.

Personnel: The entire time of one medical officer with previous special urological training was given to this work. The care of 170 patients and the responsibility of seeing them all and treating many of them each day is too much for one man, and he needs the help of at least half the time of another officer, who could take over the work in case of illness or change of the regular man.

In this work the medical officer had the aid of 1 sergeant, in charge of infirmiry; 1 private, as clerk; 2 privates, general assistants; 4 patients, cleaning infirmiry and calling patients for treatment. This help proved insufficient and should be increased.

Records: A brief history of each patient was dictated by the medical officer, within 24 hours after his admission. This was followed by his examination and first treatment. The histories are recorded on the regular clinical history forms supplied and attached to the back of the record so that it can be referred to quickly without turning over any of the various slips which form the record.

A special history sheet for syphilitic cases has now been supplied. The daily treatment is also noted in abbreviations. Syphilitic registers are posted daily in triplicate; the original goes with the patient at his discharge, one is sent to the division surgeon, and a third is retained at the camp. This insures a permanent record being at hand at all times of all known cases of syphilis in the division, and from these registers a check list may be kept, noting when the patient is to be sent for further treatment after a rest period, during which he is doing full duty with his organization.

A weekly report is also made of all new cases of infection, giving name, rank, company, organization, diagnosis, place and date of infection, whether and when prophylaxis was taken, and any remarks appropriate.

Bulletin lists: On the bulletin board in the infirmiry is posted a typewritten list of all patients in the camp classified according to disease. In squares ruled opposite each name, one for each day of the month, is indicated on each afternoon the treatment that patient is to receive the following day. From this are made up the lists of working parties for the next day.

It was also found convenient to have separate lists of syphilitics on special treatment and patients with chronic gonorrhea who received massage and sounds twice a week.

General routine: The medical officer makes rounds of the tents each morning. All cases sick in quarters are recorded as such, and the diagnosis in each case is the original diagnosis of venereal disease on which the case was admitted, and not the intercurrent ailment or complication which may be the cause of the disability.

Some syphilitics are treated in the morning and are able to go out to work in the afternoon; others are treated at the end of a day's work.

All other men are seen in the morning, and the afternoon is kept free for special work.

The morning parties are inspected in the infirmiry by the medical officer in the afternoon on their return from work. They are then treated. Any man who has not stood up well under full duty is relieved and put on light duty. No case of overwork which interfered with the satisfactory progress of the patient was observed.

Equipment: The regimental infirmiry urological set is ample and complete, and comprises articles of the best workmanship adequate for all occasions. The medical supplies, especially for the treatment of syphilis, are put up in convenient form for simple rapid administration. The other furnishings of the infirmiry were made at the camp and described in a previous report.

Treatment.—Syphilis: Syphilis has been treated according to a system in use at Hospital Broca, Paris, involving periods of intensive treatment, with intervening periods of rest, the length and sequence of the periods being controlled by Wassermann tests.

Neoarsenobenzol: Neoarsenobenzol has given no striking reactions. The medical officer who gave the injections reports that in his opinion there was less reaction where the drug was diluted up to 6 to 10 c. c., of distilled water than when given in 2 c. c. dilution, and usually no reaction at all. There was rarely any local reaction in the vein and in no case was it more than a transient soreness.

Cyanide of mercury: This drug in 1 per cent solution gave more trouble. Quoting from the medical officer's report: "Mercurialism appeared early and often after three injections. We found it necessary to reduce the dose of 1 c. c. of a 1 per cent solution one-third or even one-half. In some cases we abandoned the drug entirely and used intramuscular injections of gray oil. Mild phlebitis was common, and this in cases where it seemed certain that the needle had not gone outside the vein."

Gray oil: No reactions, local or general, followed.

Dentist: A dentist is needed in a camp of this kind to spend all or at least a part of his time. The intensive mercurial treatment requires constant dental supervision.

Gonorrhea: The acute type was treated by three to four daily hand injections of protargol in from one-half to 1 per cent solution. The patients came to the infirmary for these injections, which they took themselves under supervision of the sergeant.

The chronic type received prostatic massage and sounds twice a week, with daily irrigations of 1 to 10,000 silver nitrate or 1 to 5,000 permanganate. Many of these cases which were admitted with only a slight morning drop developed a profuse discharge after the first prostate massage; this quickly disappeared, however.

Chaneroid: Our experience with simple chaneroid was very limited. The chief trouble came from inflammatory phimosis or paraphimosis requiring dorsal slits of the prepuce. A secondary circumcision was always done in these cases after the infection had disappeared.

Results.—During six weeks, 36 cases of gonorrhea were discharged as cured—8 were acute cases and 28 of the chronic type. The supposition of cure was based simply on persistent disappearance of symptoms after passage of sounds.

Sixty cases of syphilis were under treatment, of which all but five showed marked improvement. In the latter persistent anemias or advanced cardio-vascular changes were present. The others showed marked gain in weight and general well-being.

When the camp was broken up, on June 18, 1918, all but 15 patients were returned to their organizations for duty; 8 of these were sent to a base hospital and the remaining 7 expected to join their units a few days later.

It is a pleasure to acknowledge the splendid and enthusiastic cooperation given us by the officers and personnel of the camp in carrying on this work.

Summary.—The plan outlined above seems to have proved of value in certain definite ways:

(1) It relieved the regimental medical officers of a class of work in which they usually have little interest and no special training.

(2) The morale of patients is increased by their realization that they are getting intensive treatment at the hands of specially trained men.

(3) The division gains rather than loses in effectives when venereal cases are sent to such a camp, because the amount of labor performed by the working parties greatly exceeds the amount of work these same men would accomplish in their organizations, where they are apt to be dissatisfied with their treatment and to exaggerate their physical disability.

(4) These working parties release sound men for front-line duty who otherwise would be detailed for this labor.

(5) In such camps venereal disease is actually better treated in the Army than is possible in civil practice, as here the patients are under complete control.

GENERAL CONSIDERATIONS

(1) A venereal camp of the type described is adapted for troops in areas of training, of rest, and in quiet sectors of the front.

(2) For troops in zones of active fighting or frequent movement the more scientifically ideal arrangements which can be carried out in quiet sectors must be sacrificed to the demands of military efficiency, which involve keeping with their organizations as many men as possible who can fight.

(3) During such active periods the following disposal of venereal cases is suggested:

(a) In organization infirmaries should be treated all venereal cases able to do full duty. In times of military activity they should expect to receive only such treatment as circumstances permit—this will often mean no treatment at all.

(b) To corps or army concentration camps, for the treatment of venereal disease, should be evacuated (1) trench cases of syphilis in the infectious stage; (2) other venereal cases with complications preventing men from doing full duty.

Subsequent experiences.—Following this six weeks experience, the 42d Division, like the 1st Division, was moved frequently, and was in active fighting sectors almost continuously up to the signing of the armistice, and though repeated attempts were made to reestablish these camps, they would no sooner be set up than another move would break them up again. During these months, men with venereal disease who could do full duty were kept in the front line, and their treatment was necessarily irregular or wholly lacking. It was for this reason that, realizing there must be many cases, especially of syphilis, which needed further treatment, that plans were made by the division of urology to establish one or more venereal concentration camps in each army area in which these men might receive proper care.

These plans were in turn interrupted by the armistice, and it now seems probable that for troops which remain on this side for any length of time the venereal cases will be sought out and intensively treated in divisions, and that for returning troops, venereal centers will be established at ports of embarkation where patients will be thoroughly treated before being allowed to sail.

Divisional camps in other divisions.—Besides the camps mentioned of the 1st and 42d Divisions, similar camps were established in other divisions, their success generally depending on the length of time they could be kept together, and the activity of the special division in the fighting zone. The writer is not sufficiently familiar with the details of these camps to describe them—except to mention that in the 26th Division a scheme was worked out very successfully of using patients able to do duty for laundry work for the division.

Working parties formed by patients with skin disease.—It is also worthy of mention that in divisional or other hospitals devoted to the treatment of skin diseases, patients, especially scabies cases who remain in hospital four or five days, may be used to form working parties. These are physically fit for work and, if they are treated in the morning, can work in the afternoon, or vice versa. Employment improves their morale, besides furnishing labor often urgently needed for various projects in the vicinity of the hospital. This plan was carried out in the 42d Division, and from the field hospital at that time caring for skin cases (Scratchville-by-the-Sea) 100 men were sent out in trucks in the morning for a half day's work, and another set in the afternoon.

Army Sanitary School No. 159.

HISTOPATHOLOGY OF WAR WOUNDS

By Col. Bailey K. Ashford, M. C., United States Army, September 2, 1918

Gentlemen, the truth of the matter is, this lecture, "Histopathology of war wounds," is a very important one, because it is the basis upon which modern surgery is being done, and I am going to ask you to draw as clear an idea of this histopathology as possible. Into this little talk will have to come some consideration of the missiles that are received.

Wounds in the Civil War were quite different from the wounds that we receive now because, generally, of the velocity of the bullet. They were generally bullet wounds—at least 90 per cent of them—and they were bullets that traveled at a low velocity. They were of rather large caliber, blunt, and somewhat soft; they became deformed and their tendency was to produce, in addition to the punctiform wound of entrance, a laceration and contusion to the immediate surrounding tissue through which the bullet passed. * In fact, so low was the velocity—and so large the projectile—that it very frequently was turned aside on encountering masses denser than the tissue through which it was at the time passing. For instance, if a bullet of low velocity traveling through muscular tissue encountered a bundle consisting of the nerve, vein, and artery encased in connective tissue, it was swerved aside and the nerve, vein, and artery were not injured. It happened with enough frequency to demonstrate the fact that denser tissues did swerve these bullets. That was the more striking when you consider the condition of the bone struck. Now the fractures in the Civil War were generally fractures by contact. They were not the finely comminuted bursting fractures of the high-power bullet. The consequence is that as a matter of fact infection of the bone should not

have occurred with anywhere near the ease that infection of the bones occurs in wounds of to-day, because it is the perforation of the bone and the attainment of the marrow that causes the osteomyelitis, and the fractures by contact are considered to be the less severe of the fractures because the projectile does not penetrate the bone, and, therefore, does not carry with it clothing. So in those days fractures were by contact and they tended to assume the familiar butterfly shapes that we all know about. Everybody knows that the typical fracture—contact fracture—is the butterfly fracture. The diagonal lines cross each other up and down forming the open wing of a butterfly. There are innumerable modifications of that, but in general you can trace out the butterfly. That is, of course, when the bone is not perforated, because it is comminuted and the butterfly semblance is lost. These fractures extended up and down, very frequently invading the joints, as you know. The low-powered bullet very frequently lodged in the cancellous portion of the bone, whereas a high-power bullet would cause great comminution. You should always keep before you the fact that these bullet wounds tend to produce laceration and contusion in the immediate vicinity of the tract of the bullet without any molecular death farther out than a few millimeters; that is to say, no explosive effect except in an exceedingly short range. They are said to be more painful too—I don't know how true that is—on the principle that a very sharp blow, a high-velocity bullet, doesn't hurt so much. The effects on the bone and the nerves and muscles are more important. Division in both cases would be the same whether from a high-power or low-velocity bullet; but the modern bullet will nip a nerve causing molecular death up and down in the nerve, or nip out a piece of a vessel, which may be closed up by a clot temporarily, and afterwards form traumatic aneurysm. That's the modern bullet wound to a nerve or vessel, and the old wound was a bruising which would partially or totally devitalize the nerves at that point and then would come on the infection, which did not necessarily come from the bullet wound itself but superadded. Now, undoubtedly, clothing was carried in in the Civil War just as it is to-day—not to the extent that it is to-day by any manner or means, however; no doubt about that because the velocity was low and beyond shivering the bits of cotton at the point of contact it managed to slip in without carrying much clothing, whereas the modern weapon delivers a missile that will punch it, just like a conductor's punch, and carry it in en masse, scattering fibers as it goes. The percentage of shrapnel wounds in the Civil War was from 5 to 10 per cent; it depended on the action, whether it was a tremendous bombardment previous to an advance or a tremendous bombardment to make men retire from a position. In these cases the wounds by artillery were more frequent, but in general 5 or 10 per cent were shrapnel. They rarely had other wounds because the solid shot was used for demolishing.

Now we still have shrapnel, but shrapnel has diminished to a considerably less amount than what it used to be. It used to be the *bête noire* for advancing troops, but to-day it is high explosive, and we don't have to think about shrapnel wounds as we used to. There is another thing that was brought out by an officer when I was with the French. He says the Hun uses iron. These bullets are now made of iron and they pierce the helmet very easily; the lead ones won't. The overhead shrapnel, if it were made right, wouldn't go through helmets ordinarily, but being made wrong it does go through them. As we say in Spanish "It seems as if the devil did it."

It is rather important to consider these wounds of the Civil War because in those days they didn't know anything about bacteriology—didn't use it; and the good old ladies back home used to put up packages of lint and send them to the soldiers and that used to infect wounds with intestinal bacteria homemade. Lots of old ladies with the best intentions in world sent down choice varieties of streptococci to infect the soldier lads. It was, of course, to be expected that our men would be infected; they had to have laudable pus. You will see, later, what that means. It is an extremely applicable term to-day in some ways but the whole thing was that everybody expected infection and was rather surprised when they didn't get it. But if these wounds could have been treated in the light of to-day they could have easily been treated aseptically. Those wounds of the Civil War were far more benign wounds than those we get to-day because they were localized quite strictly to the tract which they followed. If a man was unfortunate enough to have a bone fractured it didn't make

much difference whether it was a high-power or low-power bullet, but it did mean a great deal of difference if the wound was through his thigh, because then there would be actual molecular shock.

Now we come to the wounds of the South African War, the Russian-Japanese War, the Spanish-American War, and the Balkan War. I hesitated before I mentioned the Russian-Japanese War, but even then the wounds by rifle were exceeding the wounds by artillery. In certain battles the wounds by artillery were enormously frequent, far more so than in this, far more so still than in the Spanish-American or the South African War. In these we were using a high-powered bullet—in general, in these wars, the percentage of bullet wounds still hung around 90, 95—I speak from memory; I haven't any books with me to read on this subject—you remember it as well as I do—it was about 85 to 90 per cent of rifle bullets and the rest of shell. They were commencing to use shell, especially in the Russian-Japanese War, some in the Balkan War, of course; but in the South African War it was what we used to know as the old field artillery shrapnel. There the change was in the bullet they were using—a high-velocity, small-caliber bullet, weighing some 450 gm.

The effect of the bullet was that of a stiletto in the soft parts, if fired at ordinary ranges. If fired at ordinary ranges, sharp pointed, it would slip in quite easily; it would enter by a hole infinitely smaller than itself, because it would throw the skin upon the stretch, it would pierce the skin which would retract just like a rubber band when you stick it with a pin. Once inside it took up a straight course through the fleshy parts. Here its piercing quality was its chief quality; it pierced—that's what it did above everything else. The bullet that preceded it tore, rent, and contused. Being fired at a very high velocity it did not turn aside when it encountered denser tissues, but went through them, including bone. There have been a number of very beautiful examples of nice perforation of bone without much fracture surrounding it. Now the chances of hitting a vessel or a nerve square (a direct hit) are not very great, and I believe ——— in his experience in the South African War is responsible for the statement that there were more wounds of vessels and nerves because these bullets were not swerved aside. They did not lacerate them, the same energy went into piercing, but when they struck a very solid shaft of bone instead of penetrating they perforated it and burst it. Usually, however, in the soft parts, the wound of entrance and the wound of exit were not very different in size, but the wound of exit was always a little larger; but if a bone had been encountered on the way and comminution had occurred the wound of exit was even much larger than the wound of entrance, generally, but it was not always so. There were many cases where they struck a bone and comminuted everything and went out the other side. Now, we are seeing these wounds to-day; the more and more frequently we get into open warfare the more we see them. In open battle that is the wound we see; the wound of the bullet—of the sharp-nosed, high-power bullet. But its character is always that of the stiletto, and on encountering a structure like bone its tendency is to shatter. Now at short ranges of from 300 to 500 yards, this bullet has an explosive effect; that is to say, its centered energy, hitting suddenly on a substance filled with fluid or solid, like bone, and encased in unyielding casing like aponeurosis, it tends to explode, on the principle of physics that in a closed vessel, if you run up a tube the pressure on the vessel will be multiplied by the area of the cubic contents of that tube, tending to rend, tear open, and kill everything within it if it is alive. This is what happens when the brain is struck; when the liver is struck. At ranges shorter than 500 yards there is explosive effect. That must be counted with. We are going to see why in the modern weapon it is very much to be counted with. There is another kind of effect produced by a bullet over 1,500 yards where it commences to wobble or turn over; it hits butt on or sideways; there the wound is one like a shell wound, a piece of shell; it tears; laceration and contusion is here the rule—fracture of bones by contact rather than by comminution. Make a distinction between that and explosive effect. The two are very frequently confounded. Now I wish to ask you to remember that there is a little example which I like quite well in speaking of the effect of these high-power bullets, likening the bullet to a top. Throw a top on the floor and give it a spin. There is a brief time when the top trembles before it settles down to a steady spin, and just before it ceases spinning it wobbles, topples over, falls; and that is the way to look upon the matter of range of these missiles. For a short while after it leaves the mouth of the gun it wobbles. Now that wobbling movement will kill tissue for a great distance on either side of the tract. It

is molecular energy which is easily communicated to tissue cells for quite a distance and kills them; and later on the last wobble is simply to take away from the missile the property of entering as a dagger or stiletto. So in general the wounds produced by the high-power, high-velocity bullet are those which are preeminently puncturous at usual ranges and explosive when these ranges are reduced below 500 yards.

In order to increase the damage done by this bullet—which was a humane bullet, the Boers are said to have deformed these bullets and I personally have seen bullets deformed by the Germans. They have been created into dum dum bullets simply by removing the nickel jacket, exposing the lead or iron, or by taking out the bullet from the cartridge and inserting them again point first. In that case as soon as the bullet strikes it herniates and a very bad bruising is produced. But the point of all these bullets—shrapnel bullets and the low power—is that they were smooth, blunt, or sharp projectiles, but they were always smooth, in general.

Now there was even less tendency of the high-velocity bullet to carry in clothing than the bullet of the Civil War; with this sharp point it slipped in between fibers and didn't carry clothing in, ordinarily; it always carried in germs; neither the heat developed at the time of leaving the gun nor the speed through the air sterilizes it as was formerly and fondly believed; but what happened was that it did not cause very much damage to the tissue except at the point where it went in and there were not enough microorganisms carried in with them that they could not have overcome by nature's own forces; the local shock was not great enough to take away the very resistance, the local resistance of the tissues. The result is that these wounds were very promptly observed to be very much better wounds than the old wounds of the Civil War. There was not so much rending, bruising, they could be held down better by proper treatment, and very soon it became a dictum in our Army that all you had to do was to apply a first-aid bandage, a first-aid dressing, to one of these wounds and you need not worry about them at all. In other words, if a man wasn't killed he would surely get well; if he wasn't hit in some vital place he would get well; and people began to talk about it as a humane bullet and the profession began to insist on teaching all the soldiers how to put their first-aid dressing, and bye and bye, in a very short while the very Army became infiltrated with the idea that military surgery was a thing of the past; didn't have to worry much about it, all you needed was to put on a first-aid dressing—and you knew as much about that as a doctor—and give nature a chance. That was all very nice, but that had a great effect, as these things always do, on the Army.

Now, we are coming to something that I think is quite important. You know military surgery has always been the Greek slave of military necessity. Just mark what I say. At that time they always closed up all argument by saying, "It is military necessity." Now those fellows didn't realize there are military necessities of various kinds and nowadays surgery is no longer the Greek slave of military necessity, but sitting in high council with us she has got to be subjected to military necessity. We will explain how that is better later on. But, be that as it may, in those days the men who didn't care to use the Medical Corps of the Army were allowed too much to say "We don't need so many doctors; we don't need so many Hospital Corps men; we know as much about it as you do. These things are common knowledge; they have become part of our body politic. We know how to care for our own wounds; each man carry a packet and every man his own doctor." This is a fact. I remember it very well because I went into a war myself 20 years ago with that attitude; that idea in the back of every line officer's head. But the whole story had not yet been told. We were just fooling with the humane bullet those days. It was true as far as it went. The first-aid packet did do the trick for the majority of them very nicely; but then there were little foolish things like splints to be put on, compound fractures of the thigh, and bullet wounds of the skull to be treated—just little troubles like that that still existed; and at Santiago they had it brought back to them that a demand for a medical corps was still left, still needed, and that wars couldn't be won without it.

Now we come to the wounds produced in this last invasion of Europe by the Hun; and he is the same old Hun. Now just think for a moment what this war really is and what this fellow is trying to do. We went through this area that he has just besmeared; saw every one of those pretty little villages torn limb from limb, and not a house that was not wrecked. Every house that hadn't been hit enough from our own shells was blown up from the inside by

dynamite, soaked with mustard gas; fruit trees cut down; everything torn up. His aim was to destroy everything. He destroyed homes, hopes, morale, and morals—everything was to be destroyed. Now let us get down and look scientifically at the wounds this fellow makes. He has used gas; he prepared to use gas in 1914 and there is plenty of evidence that gas shells were being manufactured in 1911; some of those shells used to come over against us. When you get down to his high-explosive wound there it is that you really see that he is trying to do to the human body just exactly what he has done to villages, to homes, to that wife or that child—destruction absolute. The aim of the Hun to-day is to cut in and then blast out everything—destroy, not only where he has been but as far from him as possible. It is not only what the missile does in passing in, but it is the influence of that missile on the surrounding tissue; and nowadays you see the shell of a body, the shell of a leg, the shell of an arm, when you used to see simply a hole in the arm, a hole in the leg, because he aims to make all of his wounds explosive wounds. Now, how does he do it? He does it by the high-explosive shell. The high explosive is a devilish thing and produces a great many wounds. Leeceno told me he had seen 200 wounds produced by the grenade on one man. He does it by means of the high-velocity shell—tremendous charge of high explosive, that at 50 yards has the same explosive effect that the bullet will have, and that is the distance at which men are generally hit—50 yards. Of course, they are hit at greater distances, but it is the general thing that if a man gets 150 yards away he generally escapes, but at 50 yards the thing he gets is a piece of shell that cuts just exactly like an explosive bullet. And most of the shell wounds that we see are those. They come in at tremendous velocity and here is where they differ from all the other wounds and weapons that we have considered before; they are irregular, and at some portion they are cutting, at some portion there is an edge as sharp as a razor. Now that thing goes hurtling through into your flesh. Its irregularity will soon bring it to a stop; they are very frequently lodged. But it is hell the way it tears things to pieces. It will go through skin somewhat smaller than itself; it gets to the subcutaneous tissue and it makes a hole somewhat larger than itself, plus the tearing of vessels and the production of hematoma; it sheds off a few particles of cloth and plunges through the aponeurosis, making a hole its own size, and that aponeurosis is shredded. It then has gained the muscle which the aponeurosis covers. Of high velocity, the effect is to explode it, and here it is the high-power shell fragment does its greatest damage. The little fibers are burst and if they are not killed they are devitalized to the extent that they will die by the lack of blood supplied by the same injury, the stunning. You have the tearing of vessels here, the outpouring of blood at a great distance from the tract, so that the fibers are separated by blood clots, the circulation ceases, the roads of communication are blocked, and the situation on a battle field is created right there up to a certain point. There is no passage of blood, nutrition fails; the shattered, stunned, half-dead muscle dies from lack of food in the next few hours, and you have an organ which furnishes an ideal culture media for bacteria which are not, ordinarily, pathogenic, but which are saprophytes and feed on dead material. Now bear that in mind from to-day to to-morrow To-morrow we take up that very thing. But it is the shocking that produces material that ordinarily would do nothing if injected into healthy flesh. Reaching the bone, if it has got enough kick in it, and it probably will have, it will perforate two-thirds of the bone, passing through the marrow, and blow out the last third, breaking the bone into little bits which act as secondary missiles, making an ever-increasing dispersion. Now, here you see we have all the bad qualities of the missiles that have been used in war, plus another one which we never counted on before, namely, the sudden explosive effect—which is present only exceptionally at short ranges and only in the high-velocity bullets, and the cutting or nipping of large nerves and vessels. That is a very important thing indeed. If there is one thing more than another which is coming out of this war it is that this cutting effect has increased very much the wounds of vessels and the wounds of nerves. They are much more frequent than they used to be.

I heard no less an authority than General Ruotto, who was chief surgeon at Salonika so long, and in addition an authority on vascular surgery in the army, make the astounding statement that every wound, practically, of a vessel became a traumatic aneurism; I couldn't believe it. Leeceno, on the other hand, made the very remarkable statement that it was the majority of nerve injuries that caused paralysis, etc., where a combination of two things

always, however, happened. One was the molecular stunning or death of the axis cylinders above and below the point where it was struck or shocked by the missile, simply by the extension of these molecular vibrations. That is to say, the majority were due to the fact that the missile passed near them but didn't hit them, and up-down axis cylinders were killed—some surviving but most not; and there we get the partial paralysis following war wounds. Leceno states further in his lectures on the brain and wounds of the skull that in this war we are getting little tiny pieces of missile, very sharp, that enter the brain that don't carry in infection with them at all. They go hurtling through the brain tissue and will nip important nerve paths and produce what the experimental physiologists would like to produce in order to prove some point in physiology. In other words, there are some remarkable actions on certain paths in the brain that will explain some of the effects of a war wound of the brain. General Wallace calls attention to the fact that one of the most peculiar effects—and our own Pool, at Evacuation Hospital No. 1, corroborates it—that the most peculiar effects of war wounds were seen in wounds of the abdomen, where men have not apparently been wounded at all and yet will give the clinical signs of perforation of the intestines. Brewer mentioned that in one of his lectures. The man looked perfectly all right; he stripped him, couldn't find any wound at all; he was forced to conclude he had a rupture of the appendix. He operated and went all over his intestines until, just by accident, he thought he heard a little sound of gas escaping and found a tiny wound of the intestines, through which a tiny sliver of shell had passed, which made a pin-point opening in the intestine, and out of this came gas. So you see these shell wounds are doing some things that we really hadn't anticipated.

Now, what has happened? They cuss us in the line, saying: "You fellows are all the time changing"; and the reason why we are doing this is to keep up with them. They are changing the drinks on us; they are using new and different kinds of high-explosive shells, and it is only natural that surgery in war is changing because of the effect on the tissues when we get a new deal.

Grenades usually wound at 40 yards. These wounds are most frequently of the lower extremity, where shrapnel would be of the head and shoulders. Look out for wounds of the buttocks, because wounds of the buttocks in this war are often also wounds of the intestine. They go up through the buttocks, through the pelvis, and cause many of the severe intraabdominal wounds. Avion bombs, of course, produce things more like a railway accident than anything else. Those who are near enough generally are not in position to need any surgery.

I mentioned the wound of the bullet and shrapnel. Be careful always to consider that wounds around the shoulders are apt to be found to go through the intestine down into the abdominal cavity; that is to say, thoracic peritoneal wounds are very common, far more than what they used to be. Now, of all things remember something that a man had the courage to say to our class at the French front. "It is true that the element of infection comes from clothing and only from clothing, practically. It is the cloth that is blown in that causes infection usually." To-morrow we are going to talk about how the laws of biology will govern the development of germs in these wounds, just exactly like the crops. You have certain crops in the spring and others in the fall. Now, no matter what antiseptics you use, in some measure crops are going to come on if the wounds are at all infected. Clothing is, of course, heavily infected with the spores of anaerobic bacteria and are constantly being invaded from the soil by anaerobes, intestinal bacteria. We are fighting over a country that has received the contents of the intestinal canal of men and animals for many centuries. In fact, we have had scientists that wish to prove just exactly how many centimeters of the outer crust of Europe is feces, and the per cent of feces it contains. Well it contains enough, and the clothing, of course, is the chief source of infection. We have been told that is practically the only one. Of course, it can not be the only one, but it certainly must be the chief one, because the high-velocity bullet that used to wound us didn't produce infection ordinarily, and the shell piece that carries in the clothing does produce infection, and wherever clothing is carried in there is infection unless it is taken out; if it is large enough, unless you take away the food for the germs that it carries in with it. But if you take away the dead and devitalized tissue within 24 hours infection can be prevented. Now,

that one sentence is the exposition of modern surgery as distinguished from the surgery that we used to know years ago. It is recognition of a bacteriologic principle that we have always known, constantly used in research, namely, that if you will provide food for bacteria, these bacteria can be brought to the point where they will live in their new environment. Lecceno considers that 80 per cent of the wounds of trench warfare are due to shell, grenade, and shrapnel—80 per cent. Wallace considers it 85 per cent. Be that as it may, it is pretty universally admitted that it lies between 80 and 85 per cent, the rest being bullet wounds. Now in a war of movement—I am giving you what I have asked in my trips up that way, and I can tell you a rather remarkable story. For instance, I asked down in the Twenty-sixth, "What percentage of bullet wounds are you getting?" They had some 6,000 casualties, and they said, "About 75 per cent machine-gun or rifle and 25 per cent shell." Up at the Thirty-second I asked what kind of wounds they were getting. "About two-thirds shell and one-third bullet." Well, I immediately raised a kick. I said, "You are guessing." They said it depended entirely on the stage of the battle. If the enemy had had time to take up a position he uses shell every time. Every time he can he will use high explosive. He don't like the rifle like we do and he will use the shell. That is what was the matter. The Twenty-sixth got him on the run and he had to shoot back with what he had. He was on the run, he used machine guns—that's what he used generally. When the Thirty-second got him they had reserves and big guns and there it was that our Thirty-second, in trying to get past him, to drive him out, came up against the shells. So it depends entirely on the phase of the battle what kind of a wound you get. It shows you can not answer the questions in a dogmatic way. People ask, "What's the best arrangement for a field hospital?" It depends entirely on what kind of a sector you have.

Now the histopathology of war wounds we will just run over a little bit more because there are a few things to be said which are absolutely vital. The explosive effect in the missile that we spoke about leaves what the French call a "chamber of attrition," and in that chamber of attrition you find clothing, you find bits of skin that have been blown in, and you find pieces of tissue through which the missile has passed, and very often pieces of foreign body, and everything dead and mixed up, and the whole business has liquified by the blood that is pouring in there. Now after the twelfth hour you commence to get the multiplication of microbes and the collection of leucocytes and the transformation of these leucocytes into globules of pus.

I am going to leave the consideration of the bacteriologic portion of this matter until to-morrow. It is such a tremendously important thing that it ought not be mixed up with this. I am speaking about what actually happens to the tissues. Now in that mass of dead stuff and dying stuff, these torn vessels that constitute the numerous lines of communication of our bodies are out, our roads are blocked; their food no longer comes up and the exhausted and dying tissues have every chance of dying outright for lack of food, with the additional shock that is brought them from having their food cut off. You have got to consider that the albumins before they can be gotten rid of when they die have to coagulate, and the way they are gotten rid of naturally, by nature, is by ferments that will render them into their primary molecules. They are made up of groups of aminic acids. These acids of themselves are not toxic. All albumin has to be coagulated before it is normally digested. Examples of that are seen in milk, in the coagulation of blood, and so on. Theseamins, chemically, are crystallizable and dialyzable and are not toxic. They group themselves into polypeptones, and from there on they are built up into albumin through what we call the peptones and proteoses. Now the peptones and proteoses are poisonous, toxic,—not all, but a great many of them; the majority are toxic. Now proteolysis is a term which is used to describe the dissolution of albumins by ferments. It is in the digestion of these coagulated substances that fermentation results in breaking up of the albumin, some of it into aminic acid, but generally it only goes as far as the proteoses and peptones. Then other ferments come on that get rid of the proteoses and peptones. In the meantime they are limited, as toxic substances are escaping by lymph channels and bring about proteose intoxication. That is only necessary to recognize as a cause of fever, a cause of intoxication, which we all thought came from germs. Of course, the blood and the lymph and the muscular tissue are far more easily digested by these ferments than the fibrous tissue and the elastic tissue, which are

quite resistant. These ferments are in the nature of a diastase. These proteolytic substances are more active the sooner you get to 40° C., but you can destroy them at 65° or 70°, and you can very often cause them to suspend their action by simply chilling the tissue. It is supposed that a great deal of the good effect of heliotherapy and hot air is due to the fact that it has effect on the ferments. Now water is always noted for fermentative action and a dry wound is not apt to present much ferments as one in which liquefaction is going on. It is especially active in oxygen free action. Antiseptics have no effect on the proteose at all, as a rule, as some work in acid medium, some in neutral, and some in alkaline.

Now the sources of this diastase. They are generally natural sources. There are four sources; and we are not speaking of a theory, we are speaking of a fact. There are two of these sources that are always cited. They are the so-called autolyses. If you take muscle in perfectly aseptic condition and preserve it, there comes a time when it automatically digests itself because it contains within itself the proteolytic ferments, the autolyses. The autolysis is not very good to produce proteolysis. Then the plasma of the blood in the lymph contains a certain amount. I think a good deal of that comes from the polymorphonuclear leucocytes. They are the real sources of the majority of proteolytic ferments and they are reinforced by microbic action, the anaerobes not the aerobes. The aerobes do not produce much proteolytic ferments, but anaerobes do. Talking now about that enormous influence on digestion of the dead albumins which is exercised by the polymorphonuclear leucocytes, of course you all know the famous contention of ——— and the relative value of phagocytosis. That is recognized to-day by all men and there is no greater exponent of it than Sir Almroth Wright, whom I have the pleasure of knowing personally and with whom I have spent considerable time. I have seen him work in his laboratory and I have seen him work out to my own entire satisfaction the getting of white cells. Wright does not believe in antiseptics. Sir Cuthbert Wallace, the greatest civil surgeon that England has, says that antiseptics have failed, absolutely failed. I am prejudiced in the matter, I acknowledge it frankly, but I feel very strongly on the subject itself. Antiseptics have always seemed to me to cause a considerable amount of harm. But it is a religion with some people. Some people will defend it just as they defend the whole scripture. Sir Wright is a perfect revolutionary; he says what he thinks is right; that's all there is to it. He makes this statement: "White cells being the chief source of proteolytic ferment, the death of white cells being the chief way of liberating these ferments, it is all right at the beginning because it is nature's way of getting rid of dead material. The quickest, natural way of getting rid of dead material is to attract a large number of leucocytes, to kill them and thus liberate an enormous amount of ferments which will dissolve the dead albumin, which will clear the way for healing." That's nature's way. You know the difference between animal and man is that an animal strictly follows all of nature's ways, and man is constantly struggling to overcome nature and to better nature. A great many of us, I believe, have never stopped to think about it, the best way is nature's way. The best way is not nature's way; the difference between man and animal is just that. Now that goes along very well provided in the first place we get enough proteolytic ferments to reduce the albumins. Now the harmless amines, which are soluble and can be easily gotten out of the way, but if we only get them down to the peptones and proteolysis, then we get the intoxication which is not due to infection, and which accounts for the fever which you see coming on 24 hours after the man is hit. You have all seen that.

Now, in the healing of a wound the greatest obstacle is the large amount of pus, a large amount of white cells. It is all right at the beginning to have a large amount if you can get rid of that dead material, but to have it at the tail end of the process you continue the thing for a long time, and you get the long suppurating wounds with the constant septic intoxication, the absorption of which means a proteose. Wright thinks that all antiseptics are bad. He used hypertonic solution to get a large number of white cells, he exerted their degree of resistance and cut down the microorganisms as much as possible and prevented these long suppurations.

The vitality of granulations is in inverse proportion to the number of leucocytes they contain, and they are the cause of the process of granulation. So Policard says to preserve the life of the leucocytes, and they are the cause of the process of granulation; also get full phagocytic effect and prevent their death, which causes the outpouring of destructive pro-

teoses. For that reason he disbelieves in antiseptics. Now the French school has gone the full limit on this, and having the courage of their convictions at Boulouse they used no antiseptics at all—Carrel or anything else—wherein they err, I think. I think they have gone to the other extreme. It is very remarkable that their results are fine, but what they do is this: They have beaten nature by removing that dead tissue and the tissue that is bound to die surgically, and in that way they got rid of a large amount of dead albumin, which is a possible source of proteoses and peptones which will bring about a state of proteose intoxication and which has heretofore been confounded with septic intoxication due to germs, and that is why it is at Boulouse they don't have these septic fevers. They treat all cases surgically; they leave nothing for nature to dissolve away in her clumsy way, producing a large amount of toxic by-products, and what is left is the germ with nothing to feed on. But I believe there is a better way. I believe that when we get wounds not susceptible of primary suture we should use the Carrel-Dakin solution for the reason, with which Policard agrees, that the Carrel-Dakin solution carries leucocytes quite readily. It will dissolve away dead material quicker than any other solution so far known; a chlorine compound, it will dissolve the dead material and you can get rid of necrotic material by the Carrel-Dakin quicker than by any other means. It is constantly washing away bacteria. It oxidizes very readily and falling upon the albumin destroys it. Now the process of nature to control that albuminative process is by means of antiferments, and it has generally been conceded that the fatty acids are the controlling element as far as antiferments are concerned; that the blood contains a certain amount of the fatty acid substances and that they act as antiferments and prevent the proteolysis of albumin normally. It has been observed that gangrenous tissue, for instance, has a considerable amount of fat in it; that it will lie, as it were, without being influenced, not being dissolved. You see a bit in trench foot, for instance, as a great many of us have seen; there is a piece of perfectly dead flesh that is full of grease and fat. The instant it begins to secrete laudable pus it begins to do away with the necrotic material. That means an enormous increase in the white blood cells through death and the liberation of this ferment. The proposition is not settled, but that is the theory. The important message that I want to bring to you is this: That there are a considerable number of men that believe that a large number of so-called septic intoxications that we get are due to the fact that we are harboring dead material, which is turned into poisonous substances which are absorbed and produce part of the intoxication which we have been heretofore interpreting as having been due entirely to germs.

Army Sanitary School No. 160.

THE PREVENTION AND TREATMENT OF VENEREAL DISEASES

By Col. Edward L. Keyes, M. C.

Several members of the section of urology will come and speak to you on various topics relating to our province, which is miscalled urology. For if urology means anything it means surgery of the urinary tract, and that is one of the things which we especially have not done during our stay in France; we have been occupied with venereal diseases and skin diseases. I shall not attempt to exhibit to you my knowledge on the subject of skin diseases because we have in the department several specialists, real dermatologists, who will handle that topic. Also, Major Sanford will be here next week to tell you definitely what is being done in the fighting forces toward the control of venereal and skin diseases. What I want to talk to you about this morning is the management of venereal diseases in the Army. Just now, of course, our whole interest is no longer the winning of the war, and the enthusiasm with which we have talked to some of the previous classes has taken a different slant. Our interest in the Army work just now should be, in some measure at least, a historical one.

The senior consultant in urology, Colonel Young, landed in France early in July, 1917. He went along the British front and observed what they had done in the treatment of venereal and skin diseases; and he went a bit along the French front and saw what they had done. He visited the very large base hospitals that the British devoted to the treatment of venereal diseases, and he was immediately impressed with the number of beds wasted for the treatment of these diseases by both the French and the British Armies.

Many of you perhaps realize how great the shortage of beds has been at various times during the past summer, and you perhaps realize that it was apparent if this war kept on we should need two, three, or four times as many hospital beds as we have at the present time. Now, on the English standard, it was proposed that there should be about 10,000 venereal beds per 1,000,000 men; so that we should have had about 20,000 venereal beds if we had 2,000,000 men over here, which was the number we expected this winter. Obviously that was a great wastage of hospital beds for patients who did not particularly need them; they do not, generally speaking, need to lie in bed at all; they don't in civil life. So it seemed a great wastage to put them in hospitals as the British, French, and Germans have done.

In the second place, Colonel Young was impressed with the fact that by putting a man in hospital when he got venereal disease you gave him a very good reason for getting infected. If he was in the line and exposed to fire he had only to get a dose of gonorrhea and get back to a comfortable hospital in the rear and spend many weeks in peace and quiet. It put a premium on self-inflicted venereal disease. There are two ways of doing this: The men may pass the pus from one urethra to another in the trenches, or they may cohabit with women who can guarantee to pass them gonorrhea. That is alleged of one of the towns at home and of several here. In a certain French city it is said that the women get twice the usual price if they can guarantee venereal disease. They do not always make good. Colonel Young was impressed with the shirking possible from self-inflicted venereal disease. The British told me it did not assume any importance in any of their armies. Whether they know how important it is remains of course, a question. However, taking these two basic principles, hospital beds wasted and men shirking duty by means of venereal disease, Colonel Young devised a theory which was expounded in a book which was published by the department last spring, that all venereal cases should be treated in their organizations. This book, the *Manual of Military Urology*, can be gotten from the Medical Supply Depot No. 3 by applying through the regular channels. The theory was that the man should be treated, each in his own organization, by his own organization surgeon. That theory has worked well in the Services of Supply. In the fighting lines it was soon discovered to be impracticable. Those of you who have been in the line realize why. The units are sobroken up, the men are so frequently separated from the main body of their unit, their surgeon, etc., that even were it possible to have the physical facilities to treat the disease in the trenches you couldn't get at the man to treat him. It proved impossible. As a compromise the divisional venereals were therefore collected in a venereal labor camp, usually situated at a field hospital. Major Sanford will describe to you in a subsequent lecture the nature of these camps.

But we had difficulty not only with the men in the fighting divisions, but also with the replacements. A division, as you know, is made up not only of the men in it but is constantly being resupplied with large numbers of men in order to replace those fallen in battle or who come down sick. These men are supplied by the depot divisions; and if venereals in line divisions are detached to labor camps, as they are called, it is sheer waste to send up new venereals from the depots. So venereal camps were established in the depot divisions. Moreover, had the fighting continued we should have been obliged to establish army camps for the evacuation of venereals from divisions actually in the fighting. An order for the establishment of these had just been issued when the war came to an end. The details of all this Major Sanford will give you. The depot labor has been working since the end of July in the 1st Depot Division, which handled most of our replacements; and it has worked so well that we can feel that it is perfectly practical. The army labor camp has never yet really functioned. We started with divisional camps, and on account of the slowness of getting orders changed we have only just got the plans of our army labor camps approved, and now the war is stopped. The stoppage of the war was a good thing for us individually, but a bad thing for the organization. So far as we have gotten, therefore, the underlying plan of capturing venereals and preventing their cluttering up the fighting forces is to have divisional labor camps, army labor camps, and replacement division labor camps.

Now let me tell you what I mean by labor camp. The idea of the labor camp is that all venereals who have not got complications of some sort, such as suppurating buboes or swollen testicles, should be kept at work as far as possible. The venereals in civil life keep on working; in army life they can do certain types of work. If you keep them in the trenches or at hard physical work, they will come down with complications that will knock them out for a month or two and you will lose more than you gain. By putting them in labor camps you treat their disease adequately, waste no hospital beds, which ought to be used for sick people, you keep them under military discipline and they are of some use to the army by the work they are able to do.

Take the 1st Depot Division medical labor camp as an example: They are divided into three companies, A, B, and C., in duty status, and a fourth company, D., hospitalized. Company D constitutes about 20 per cent of the men, chiefly acute gonorrheics during the first week or 10 days of their treatment. All patients with complications also go into class D. A, B, and C classes are managed by A class doing full duty, viz, road digging, piling lumber, any work however heavy it may be. B does moderately heavy work except straining work, and C does only light work, such as light kitchen details and policing around the camp; duties that require very little physical effort and very little moving around. If a patient comes in with acute gonorrhea he is put in class D for a few days and treated according to his needs medically. If he shows he is not going to have any complications he is immediately put into class C. He is kept there until his discharge is diminished, and then he is moved up to class B, and when his discharge becomes relatively unimportant he is moved up to class A.

Now in order for the camp to succeed it must be located where there is work to be done. That must be the headquarters of something; at a railhead, at a dump, at a quartermaster headquarters, at an engineer headquarters. The type of work to be done is governed by circumstances. At this first depot the men paint signs, mend roads, pile lumber, and haul things around for the quartermaster. Building coffins was one of the earliest of productive occupations of this camp because they had just got going well when the grippe struck them and they had to supply 20 to 30 coffins a day for the division. The camp treatment of venereals has been extraordinarily satisfactory in that we have not wasted ten or twenty thousand beds and we have been able to exercise a certain disciplinary action over these venereals and keep them at work and not allow them to run down as they would do if they were in hospitals. On the other hand, it may be argued that we are treating a large number of venereals with their organizations, which means we are not treating them well. I am inclined to believe that there is something in that argument. The average regimental surgeon is not interested in venereal diseases. You can hand him books and literature on the subject as much as you please, but he won't bother with them. That is extremely bad for the syphilitics, and a certain number of them have suffered. But even the best hospital care does not guarantee them the cure of gonorrheics. I have studied with some interest the results obtained by the British, who keep their patients there for 6, 8, or 10 weeks, and in one hospital as long as 12 weeks, on the average. But despite this care there is quite a group who spend their time going to hospital and back to the line and back to the hospital again. On the other hand, the results of treatment by regimental surgeons on the whole averages extremely good. Complications are few because the treatment is simple.

As I said in the beginning, much the most important thing is the plan of prevention, and first of all let me give you a few words about what you have heard so much about, and seen so much of—the prophylactic station. The United States Army and Navy were the first in the field with venereal prophylaxis, which was officially recognized in the Army in 1912. During the past year both the British and French Armies have introduced it; but without any penalties attached; therefore, one may well doubt whether it will prove effective among our Allies.

The results of prophylaxis in the American Expeditionary Forces are excellent. At Bordeaux they have kept larger records than anywhere else—they have run up to 150,000 at the present time. That covers a little over a year and they have less than 2 per cent of failures among those 150,000 taken, regardless of the time at which the prophylaxis was taken, that is to say, 1.7 per cent of these 150,000 men have had venereal disease following prophylaxis.

laxis. It is presumed—the presumption is a little indefinite—but it is presumed that the average prospect of getting venereal disease for a soldier who exposed himself is about 1 in 10. If that is so, and I think that is a fairly liberal figure, considering the kind of people he picks up, prophylaxis reduces the danger of infection to about one-fifth of what it would be without prophylaxis. Now, of course, if prophylaxis is well given and given early, the results are even better, and some sets of figures covering a few hundred or thousand cases have shown that if prophylaxis is given within one hour, it is certain, as far as one can humanly say, to prevent the disease. Within three hours the percentage of failure is still smaller, and it is only when you get up to seven hours that it runs up to the average failure, meaning that you are not doing the patient any good at all.

But it is extremely difficult to get prophylaxis well given. It is of the greatest importance that you should study the methods of giving prophylaxis that are employed by the men in your outfit. One must go around and look over the prophylaxis station and see whether it is clean and decent and whether the attendant is on the job. Unless you do that the treatment will be badly given. There are two ways to give it badly: One is to give it so it won't do medically what it is meant to do, the other is to give it in such a fashion as to persuade the man never to come back for another prophylaxis. Let me take the second one first. Your prophylaxis station should be a somewhat decent spot; it shouldn't be the dirtiest hole in the camp; it should be policed as well as may be, and some effort should be made to have the materials and system of arrangement in running such that the man in charge of the giving of the prophylaxis shall take some pride in it. There are two ways of achieving this: One is to inspect frequently, and the other is to make the attendant a professor in the giving of prophylaxis; and see to it that all the Medical Corps men are taught how to give prophylaxis. In that way he will develop a very natural pride in the method of doing it, and then when his turn comes to let up and some one else takes charge of the prophylaxis station the job can be handed down and the men will take some pride in both getting the medical effect and not hurting the patients. A man can be considerably hurt by the protargol injection. Sometimes it will hurt them. Some men faint. A little discretion on the part of your men will bring you back a good crop of men for further prophylaxis who might not otherwise come back.

Now as to the medical side of the prophylaxis, there are several points that are worthy of consideration. The most notable one is that the way you get your hands clean is by washing them with soap and water. As soon as anybody's mind turns to medical things, they run to antiseptics and away from soap and water. Now the way to clean off a man's penis after cohabitation with an uncertain female is to wash it with soap and water. I am rather a partisan to ablutions in whisky to prevent venereal disease. It has been employed by many people who are experienced in that matter, for a number of years, to my certain knowledge. Fifty per cent alcohol is a fair antiseptic and that's about what whisky is, and I should say that if a man were to use soap and water immediately after cohabitation and follow it with a douche of whisky—brandy in this country—that he probably would keep himself free from venereal disease. However, you can't trust prophylaxis to the man himself. Prophylaxis, I believe, is going to fail in the British Army because they entrust it to the man himself. They hand out the materials and tell him to use it himself. That won't work. It is hard enough to have it done right when it is done at the prophylaxis station where the men are specially trained. You should always include the washing in soap and water as the first step, because, if for no other reason, the patient is very likely to develop chancreoid and syphilis. We have record of a number of epidemics of chancreoid, so-called, chancreoid complicated by syphilis; several epidemics have broken out in men who have taken prophylaxis well and early, and in each instance it was given without a preliminary washing with soap and water. Now all these things you can find much better put out in the appendices of the Manual of Military Urology, where methods of good prophylaxis are described, but I feel it worth while to go over with you because we have found that venereal diseases are much neglected and so are the prophylaxis stations neglected. There is one thing more about prophylaxis stations. The best thing I can tell you is this: That while we are not ambitious to have the greatest number of prophylaxis given, yet if the station doesn't do enough work to keep the men in practice they will give rotten prophylaxis. If the sergeant is reading the *la Vie Parisienne* six days a week and gives prophylaxis only one day a week he won't do

good work; on the other hand, if you are running 250 a day as in Bordeaux and Paris, the prophylaxis is extremely well given. Endeavor should be made to have it run in such a way that it will do the greatest possible business.

I think I have time to speak of one more thing, and that is the lectures to the men, which after all is the only other strictly military thing I am going to speak of. I don't speak of courts-martial, and so forth; as to lecturing to the men, I quite agree with a good many that there are two sides to the question of lecturing men on the subject of venereal disease, and I quite agree that certain lectures probably do more harm than good. At the same time, I think it is wise; it is necessary—it is ordered in general orders, it is also wise—that some effort should be made to get the men properly informed as to the dangers that they run in having intercourse with casual females. I don't think there is any harm in presenting them with information; I do think that the harm comes in when the man who lectures permits his own individuality to get away with him and then proceeds to talk on morals which the doughboy is entirely unable to comprehend, or else who tries to throw the fear of venereal diseases too strongly into the men. It is not at all clear to me that the average medical man gives a good lecture on venereal diseases to the average nonmedical audience. We are inclined to go formally through the various symptoms of the three principal venereal diseases and leave an impression upon the minds of the men that we think that if they get venereal disease they will have all those symptoms. On the other hand, these fellows know a thing or two and they know a good many men who have had the clap and who presented a singularly healthy appearance and are able to enjoy life pretty much as the rest of the world does, and they are very likely to get the impression that you are trying to "throw the bull" at them when they contrast the known facts with what a man says when he tries to scare them too much with venereal disease. You can not keep the men afraid of the boche; and you can not keep them afraid of venereal disease. The men that they know who have venereal disease will not correspond with the impression they get from the lectures from the officers who try to scare them. You will scare a certain portion of the men and they are the men who know they have syphilis, and others (which is far worse) the men who think they have syphilis; and if you depict the horrors of gonorrhea they will pester you as you deserve; so don't lay it on too thick. But plainly state to the men that they should use prophylaxis and not run the risk; I think you should plainly set that before them.

The final point I think comes up in the minds of many men: Why not issue condoms to the men and let it go at that? Well, because like everything else human, it doesn't work. The New Zealanders and, I believe, the Australians issue condoms in their army. When I was with them I was very interested and talked to the sergeants. They are the people in the army who know what is going on. I talked to the men in charge of the prophylaxis stations and inquired what they learned as a result of their various methods. They handed out a packet very much like the officers' packet—a little collapsible tube of calomel with camphor and carbolic acid in it. As you know, these used to be handed out in the Navy, and the result was that the boys played craps for them and the winner went on shore and sold them to a druggist. The passing out of condoms to the New Zealanders and Australians, if you can judge from what a sergeant in charge of these stations told me—when I got them separated from the officer—was that about half the men used the condoms and half didn't, because they didn't think that that was the way to play the game. A large proportion won't use them. But in the meantime it doesn't cover the question, and I confess myself frankly opposed to the proposition of giving condoms to the men, because I don't think you should hand them out a license to cohabit, and the condom pretends to represent an absolute guarantee. If you give him a condom you will separate him from the idea of coming in for prophylaxis. On the other hand, I think from my civil practice before the war, from what I have seen in the Army, that the giving of prophylaxis treatment is far safer than the condoms. Our system is not yet perfect; it will be improved in some of its details. But what it most needs everywhere in the American Expeditionary Forces is for the medical man to take the trouble to see that he has a prophylaxis station that he doesn't have to be ashamed of, and see that he has a man running the station who is not a congenital moron and who is somewhat interested in making the thing work right.

Army Sanitary School No. 161.

THE FIELD HOSPITAL IN CAMPAIGN

By Major Spear, M. C., December 4, 1918

I did not know until yesterday that I was expected to come down here and say anything. This isn't going to be a lecture; I am just going to tell you, in as good form as I can, what we had to contend with and what we did.

When we came over we were filled up with M. M. D. ideas. I came over here myself in an advance school detachment presumably to come to this school. I landed in Brest, stayed there three weeks and got orders to rejoin the division; so I did not have a chance to come here. The night that I rejoined the division the sanitary train had also gotten in and we went right to work. We thought, of course, that we were going into field hospital work and have nothing but field hospital work to do. We went into the Toul sector. Two hospitals took over base hospitals. They were field hospitals by name, but they were acting as base hospitals; and two other field hospitals really went into the field hospital work. I don't know whether any of this class has gone up to the Toul sector and has seen any of these hospitals up there?

The CLASS. No, sir.

Major SPEAR. When we were up there they brought two or three detachments from this school up there.

Well, one hospital took over, as I say, a base hospital in Toul and handled all the sick of the division. The other hospital in Toul handled all contagious cases. One hospital was on one half of our sector acting as triage or sifting station; the other hospital was on the left half of the sector acting as triage. Triage work consists in sifting of all cases. There the gassed cases are given preliminary treatment—held if necessary, or evacuated if they are so severe as to make evacuation dangerous. Wounded are redressed if necessary and immediately evacuated. That worked very well when we were in a quiet sector, getting not over 15 or 20 wounded in a day and perhaps 3 or 4 gassed cases. Many a day we didn't get any gas cases and there have been a few days when we didn't get any wounded. The organization at those times worked very well. Everyone could do just exactly what he was supposed to do, and the evacuations went along without any trouble. There were always three or four ambulances there ready to evacuate one patient if necessary.

The organization of the triage in this sector had been perfected by the field hospitals of the 26th Division. We had quite a bit of our work mapped out and perfected for us when we took over. The situation was ideal. The ambulances could come right in, unload at the receiving and forwarding station, and drive around in a circle and go out. The evacuation ambulances were splendid, and all they had to do was to drive right up to the receiving and forwarding station, get their load, and go out another way. There were no crossed roads; the evacuation to the rear and the incoming patients from the front never bumped into one another, you might say. Everything was mapped out ideally for a triage, and that is what you must have to facilitate your work; you must have an incoming road and an outgoing way for your patients coming from the front; you must have a place to evacuate that does not in any way interfere with the other route, because if you do and you get into a push you are going to get so congested in a short while that you can't handle it. The only push that that triage got into the whole time we were in the Toul sector was on the 8th of August when the Eighty-ninth took over the Eighty-second. The Eighty-ninth ran into a bunch of gas, and they were severely gassed men, who were coughing up practically casts of their bronchii; their eyes were severely burned; they had splash burns all over the body. The least severely gassed of the whole bunch was as badly gassed as any that I saw in the St. Mihiel and the Argonne drives. In 20 hours we put through there, in that triage, seven hundred and thirty and some cases of severely gassed. They were all washed—undressed first—treated, and evacuated; every one of those cases but 16 who were so severely gassed that they had to remain at the hospital. This was only possible because of the way the triage was situated. There was no congestion; if there had been it would have been impossible to handle it. The organization of the triage in the gas department consisted of, first, the commanding officer having, of course, charge of everything; one noncommissioned officer

in charge of the washroom; one noncommissioned officer in charge of three wards; and another noncommissioned officer in charge of three more wards. Luckily we had in our two hospitals acting as base hospitals some female nurses, and when we got into this push we took these female nurses up and had them assist in the treatment, especially the eye treatment of these patients. Otherwise, the personnel of a field hospital would have been so far below the number required that it could not have been handled, and we were helped out on that by one of the 89th Division hospitals that was there ready to take over our hospital. The only thing that helped, or the only thing that let us get rid of that number of patients in that short time, was the organization and the system of outlet and inlet—no bumping into one another.

In Toul the sick hospital and the contagious hospital, acting as base hospitals, took care of, at times, 600 and oftentimes more patients at one time. Here we were pretty well stumped lots of times with only the personnel—6 officers, and sometimes we had only 4 or 5 and oftentimes less, and the number of personnel sometimes down as low as 60 men. It was a proposition, but they were things that a field hospital is liable to have to handle. What was the average, Captain Flagler, of that field hospital?

Captain FLAGLER. We took it over with 400 and got it down to 200 by evacuation; and it was 630 when we turned it over, on account of the gas.

Major SPEAR. That was the way we had it in those two field hospitals; from 200 to 630. It was absolutely beyond field hospital work, but we were put in there and we had to do the work, because the base hospitals were not completed in this region at the time; there was nowhere to send them and it was a thing that had to be taken care of and there was nothing else to do but do the best we could, and all this was done when we were in a quiet sector—very quiet as I say. Oftentimes no wounded would come in during the day, or may be we would get only one with an accidental wound, a hand grenade went off in his hand and may be injured him or some one near him—nothing serious. The average there was around 15 to 20 a day—not over that.

Then as to our equipment: We came over with our field hospital equipment minus our tentage. When we took over these hospitals everything was there; the beds were there in the triage; we had Bessonneau tents and a large airplane hangar. There were beds, sheets, pillows, mattresses, bedpans, urinals—everything that was necessary for the treatment of patients. In the base hospitals that we ran there were, of course, beds, mattresses, and in the officer's ward we had 40 beds for officers with bedspreads, and so forth, and everything was there to do it with.

Then from the Toul sector we went into the Pont-a-Mousson sector; our division held the Pont-a-Mousson end in the St. Mihiel drive. There one field hospital acted as a triage again; one acted as a nontransportable hospital; one as a gas hospital; and one as a sick hospital. At the triage the same thing obtained as in the quiet sector. Instead of putting up tentage, we had an old tannery that was nicely divided off into sections, and we selected one for the treatment of surgical cases, one for the treatment of gassed cases, and one for the treatment of shock. At the triage at this time we had the division orthopedist, the division medical gas officer, and the division psychiatrist. We tried to sift out in every way possible all the cases that came there right at this sifting station. The psychiatrist would take the neurotic cases and send them over straight to the rear into Toul, or he would send them to the sick hospital. The division orthopedist was responsible for the condition of every splint that went out of that triage. The division medical gas officer was responsible for the treatment and the sifting of all the gassed cases. The hospital personnel and the officers of the hospital did all the treatment that was necessary—the changing of dressings, feeding the patients, taking off their clothing, under the supervision of these specialists. At the nontransportable wounded hospital we had an X-ray outfit; for a while we had a surgical team with two female nurses. We were operating in an old French hospital of Adrian huts which were well planned out. We dropped right into an X-ray room; all warm. All we had to do was to take out X-ray apparatus in there and set it up. From the triage all nontransportable wounded were sent there to be operated on—the nontransportable wounded cases, consisting of perforating abdominal wounds, the sucking chest wounds, and all badly shocked cases.

The sick hospital, of course, treated the ordinary sick. The gas hospital treated all the gassed. And right here the gas question comes up. One of the worst things we had to contend with was the differentiation between gassed and malingerers. Right at this time there was not much literature put out by the chief surgeon, A. E. F., as to what to do and what not to do with gassed people. Orders were that if a man came up and said he was gassed he was to be treated as a gassed patient and be treated as a litter patient. That all worked very well in a quiet sector like the Toul sector, but when you have 500 to 600 men to evacuate in 24 hours you can not comply with these things; you have got to use your medical knowledge and differentiate between a man who is slightly gassed and a man who is really gassed and a malingerer. That is all supposed to be handled by the division medical gas officer, but one man can not do it. As a consequence, into your gas hospital get men of all three classes. And when you have a hospital with a capacity of 250 people and you have 500 to 600 sent back in a day you have got to evacuate to the rear, and you have got to evacuate them sitting, because you can't get transportation to evacuate them as litter patients, and it is impossible to comply with the instructions saying that you will hold them for three or four days and differentiate between the gassed and nongassed and then send them back to duty or to the rear, as the case may be. In the Pont-a-Mousson sector we had that very forcibly brought to our attention. We had between 500 and 600 men in there inside of 24 hours. We had to evacuate what came back from the field hospitals, and we evacuated a bunch of men who showed no symptoms whatever. We had to do it to make room in the hospitals for men coming from the front. The next day the division surgeon asked me to come to Toul with him to investigate the matter, and we went there and men from our division were then being evacuated from the gas hospital in Toul on an evacuation train. It had been 36 hours since some of them had been gassed, and some of them had been gassed for 48 hours. When they left our hospital they showed no signs whatever of having been gassed. We had to evacuate them, as I say, to make room for others. When they were walking to the train at the end of that time they were just developing gas symptoms; some were just developing conjunctivitis; some were just developing burns; and that was the class of cases that we had been criticized for sending back. Orders are that you shall keep these men in your division hospital until you can determine whether they are gassed or not; but if you get in a push you can't do it, because you have capacity for only so many and you can only keep that many. You have got to evacuate as fast as you can.

From the Pont-a-Mousson sector we were shifted over into the Argonne. All we had to move was our men, leaving the equipment behind. We moved out and we had a rest of about two days and then the division was ordered into action. We went into action in the Argonne. We had one field hospital complete and tentage for three others, and all that these other three had were a medical and surgical chest, a sterilizing chest, about 25 litters, and 75 blankets. That's all we started into the Argonne with. I got orders to establish a triage one night. At 8 o'clock when I got the orders we had about 15 miles to go and be ready to function the next morning at daylight. We got three or four trucks that were assigned to us loaded and got onto the road. You could move about 100 yards every 15 minutes. But we got up there, got the triage established, and were ready to work about 8.30. and they immediately threw a bunch of cases in on us. All we had to work with was a medical and surgical chest, a sterilizing chest, and some bandages, and the wounded came in by the truck load and ambulance load. The medical supply man immediately got on the job, and it wasn't long before he had enough equipment up there to tide us through. That same day we established a gas hospital alongside the triage, leaving the sick hospital back in the rear. We had, as I say, no equipment with us. If a man came in and had to move his bowels, we gave him a helmet. An official report went in criticizing us for allowing a man to use a helmet to move his bowels, but I think it was a pretty good idea; but one of the corps specialists came in and saw it and put in an official complaint about it. But we had no equipment and that was the best we could do. While we were up there a shell came in and killed 11 men and wounded about a dozen or 15 more. These men were in the kitchen or around it. It came right in the door. The shell was just about spent apparently; that is, the gun was quite a distance off, a long-range gun, and it hit right alongside the field range. We were right at the crossroads; we had orders to be there; and although we complained about it, we had to establish there, and the boche

began shelling the crossroads and hit us. We were near Varennes then; it was just at the beginning of the Argonne drive. While we were up there our equipment was, of course, increased quite a bit. After being there a few days we moved up to Avocourt. As to transportation, we had practically no transportation. In our division we had four G. M. C.'s, four Fords, and two S. S. U. units. We had during the greatest period of activity one evacuation ambulance company having anywhere from 8 to 12 ambulance to help us. Now the personnel. The number of personnel required to run a field hospital is at least 120 if you are going to run it and run it right; you can not run a field hospital with 83 men and get away with the work unless you tire your men to such an extent you can not get any service out of them.

Another thing that must be established to keep your hospitals from filling up is liaison with the rear at all times. If you don't have that it is going to be bad for the patients, bad for every one concerned.

Army Sanitary School No. 163.

GENERAL CONSIDERATIONS OF THE WOUNDS OF WAR

By Col. Joseph A. Blake, M. C.

Wounds of war differ from those usually observed in civil life in that they are produced by missiles traveling at comparatively high velocities. Without entering too far into a theoretical discussion, we may say that the effects produced on the tissues of the body depend chiefly upon the nature and the velocity of the missile.

The principles missiles are rifle balls, shrapnel balls, shell and grenade fragments, to which we must add secondary missiles consisting of various substances to which velocity has been imparted by the impact or explosion of the first named. This latter group comprises fragments of stone, wood, accouterment, or of bone.

The effects produced by rifle balls are exceedingly diverse and depend not only upon their velocity but upon whether they strike on end or are tumbling, whether they are deformed or not, and also upon the nature of the tissues on which their energy is expended. For instance, we know that a rifle ball at certain velocities may pass entirely through a limb or the body with a minimum destruction of tissue. In such cases the wound of entrance and exit are both small and punctate, no more injury being done than if a sharp-pointed skewer had trans-fixed the parts. When traveling at a still lower velocity they may become lodged. At higher velocities they often produce the so-called explosive effects, which is largely due to the spattering of the ball, the shattering of bone, and the imparting of its energy to the fragments of the latter, thus producing secondary missiles. True explosive effects are observed in wounds of the cranium. An undeformed rifle ball seldom entrains clothing or other foreign substances, and the seriousness of the wounds caused by it depends almost entirely upon the amount of tissue destruction. As a rule, rifle balls remain in the tissues without causing irritation.

Shrapnel balls possess some of the characteristics of rifle balls traveling at low velocity. They are often lodged—the wounds of entrance are small and as a rule they do not entrain infected materials, and therefore, if an operation for their removal is likely to be serious they may be allowed to remain in the tissues.

Almost every variety of wound may be caused by shell, the character depending largely upon the size of the fragments, for their velocity is generally low. The great seriousness of these wounds is due to the fact that the fragments of shell usually punch out portions of the clothing corresponding exactly in shape and size to the striking side of the fragment. If the fragment lodges, then clothing usually remains attached to it; if the fragment passes through, portions of the clothing are as a rule detached and remain in the tissue. As the clothing contains all sorts of bacteria and particularly those indigenous to the soil, a more efficient method of infection could hardly be imagined. In this connection it may be mentioned that it has been noticed, at least in the British Army, that in recent fighting over devastated country the incidence of gas gangrene was much less than was the case when the soil was under cultivation and full of anaerobic germs.

A grenade bursts into very small fragments and the seriousness of the wounds produced by them lies in their multiplicity rather than their size. Each fragment may carry in its

little piece of clothing and consequently the body may be peppered with little foci of infection. It is practically impossible to operate on all the minute wounds, possible a hundred or more, and not infrequently death results after some days from general infection.

Let us now consider in somewhat greater detail the effects produced by missiles on the tissues. The skin may be perforated; portions of it may be punched out and carried in, or torn away, or large flaps may be raised. The point to bear in mind is that only the edges and fringes are devitalized, and therefore it is unnecessary to sacrifice more than these when operating.

The injuries to the muscles possess the greatest pathological significance. As has already been noted, the effects of the missiles are various. Usually the muscles are torn, shredded, or pulped, and portions are detached from their vessels. This dead or devitalized muscle tissue is the breeding ground par excellence for bacteria, particularly the anaerobes, and the successful treatment of war wounds is based upon its surgical removal.

Nerves, and to a less degree blood vessels, present more resistance to explosive effects, and frequently a nerve is found practically intact passing across a cavity or through a mass of pulped muscles.

The effects produced by missiles on bones are extremely diverse, depending upon the nature of the missile, its velocity, and upon the character of the bone itself. Wounds of the diaphyses differ from those of the epiphyses on account of the difference in the architecture of the bone. The effects on the diaphyses depend also upon strains set up by the muscles at the moment of impact, as well as by the nodes of vibration. I have under observation at the present time a transverse fracture of the femur above its middle caused by a bullet which made a clean hole through the lower third of the shaft.

Passing by an interminable discussion of the various lesions that may be produced, I wish to call your attention to some points which are of the greatest clinical importance. Firstly, in regard to diaphyseal fractures, is the distinction first made, I believe, by Leriche, between fractures by contact and by penetration or perforation. In the fracture by contact the missile stops at the surface of the bone and consequently no infectious material is carried into the medullary cavity. On the other hand, in the fracture by penetration or perforation, the missile lodges in the medulla, or in passing across it may leave portions of its burden of infectious material which has been torn away by the sharp irregular fragments of bone. It is evident that in the treatment of the fracture by contact no exploration of the fracture is necessary, while in that by penetration or perforation it is imperative. The second point is in regard to the lesions produced by missiles to cancellous bone which forms the epiphyses of the long bones and the carpal and tarsal bones. While extensive fragmentation of cancellous tissue may be caused, I wish to draw your attention more particularly to the small punctured wounds frequently produced by small shell fragments. These at first sight appear almost negligible, yet they are often the most dangerous and refractory bone lesions we meet with for the following reasons: The path of the missile is commonly closed by the elasticity of the shell of the bone, which folds in and springs back; the tract is as a rule infected; in addition hemorrhagic areas are produced throughout tissue which form areas of diminished resistance and later foci of suppuration. Consequently, those wounds are apt to lead to interminable suppuration and to infection of contiguous joints. To prevent such disastrous results, it is necessary to find and remove the entire tract with the missile, which is generally a difficult operation and one entailing much greater sacrifice of bone than would seem justifiable; especially as the defects thus produced are repaired by connective tissue and only slightly by ingrowth of bone. It is better, sometimes, to resect articulations rather than be satisfied with partial removal of devitalized and infected cancellous bone. The decision as to what should be done requires experience and judgment. It is as wrong to denounce all resections and excisions as it is to practice them too generally.

Let us now consider the principles upon which the treatment of war wounds is based. They are as follows:

First. The elimination of contamination before infection becomes established. Contamination becomes infection as soon as the bacteria commence to pullulate and extend throughout the wound, which requires about 8 hours for the anaerobes and about 12 hours for the pyogenic cocci. Operations should therefore be done before the expiration of 8 hours in

order to be consistently successful. But it has been found, especially recently, that very many operations are successful as far as wound healing is concerned at much later periods, even when 36 to 48 hours have elapsed. These late successes lead one to believe that the next principle to be enunciated possesses a greater importance than hitherto believed. This second principle is the elimination of the pabulum for the bacteria. This should be accomplished by the operation and consists, as we shall see later, when we come to consider the technique, in the complete removal of all dead and devitalized tissues, leaving the wound as if it had been made by the stroke of a clean sharp scalpel.

If through lack of skill, or for anatomical reasons, this procedure has been imperfect, we call to our aid chemical or physiological substances which dissolve or hasten the elimination of this bacterial food and sometimes destroy the bacteria themselves; such as the various antiseptic fluids and more particularly the hypochlorites.

Third, and very important, is the principle that we have all been taught, but are apt to forget, and that is, the elimination of pockets and dead spaces in which bacterial food may reaccumulate; and, if we can not eliminate them, the installation of efficient drainage.

In addition to the principles already enumerated the following must be mentioned, which are in the line of conservation rather than that of direct wound treatment. These are:

First. Prevention of augmentation of injury, which is accomplished by proper transport splinting and in which the essential underlying principle is traction, as exemplified in the Thomas splint.

Second. Restitution of structure and form, as, for instance, the reduction of fractures and the suture of muscles, tendons, ligaments, synovia, nerves, and in general all plastic operations.

Third. Retention of form, as accomplished by splints, traction, etc.

Fourth. Maintenance of function, such as is accomplished by the methods of suspension combined with traction that have been perfected during the war.

Fifth. Restoration of function, as is obtained by nerve and tendon operations and by proper exercises and massage.

A résumé in chronological sequence of the steps in the treatment of a wounded man would be:

First. Splinting for evacuation from the battle field.

Second. The primary operation, which includes elimination of contamination; that is, removal of foreign material, elimination of pabulum for bacteria that is dead and devitalized tissue, and, lastly, restitution of structure when possible.

Third. The aftertreatment, which includes retention of form, the use of chemical solvents and bactericides when necessary, secondary suture when needed, and, finally restoration of function.

Before entering upon a detailed description of the application of all the principles I have enunciated, for one's time is limited, I shall touch upon some of the later developments in the preventive treatment of infection. The preventive treatment of tetanus is familiar to all of you, but some of you may not be aware of its limitations. The protection afforded by a dose of antitoxin lasts apparently only from 10 to 14 days, hence the necessity of repeating the dose within that time, and also before any later operative intervention which may open fresh channels for absorption, the tetanus bacillus commonly remaining in wounds for many weeks. In fact, the slight traumatism caused by roughly handling a fracture may be sufficient to provoke the disease. Many cases of late tetanus are not recognized. Within the past week one came under my observation which had been evacuated a day's journey by automobile, although the symptoms had been present for at least a week. As ordinarily observed in such cases, the disease first manifests itself by local contractions in the fractured limb (for usually there is a fracture), which often are present for some time before the more characteristic ones appear. The treatment of those cases is after a sensitizing dose of antitoxin to give large doses, in the neighborhood of 100,000 units in the 24 hours, most of it intramuscularly. Happily most of these cases recover.

Exceedingly encouraging reports are coming in in regard to the preventive treatment of gas gangrene by the use of antisera. In the early part of this year the antitoxic serum developed by Bull at the Rockefeller Institute was given a trial in the British Army but the data collected were insufficient to prove its efficacy. Later an extended comparative trial was

instituted in the same army. A double antitoxic serum was prepared against the *Bacillus aerogenes capsulatus* and the tetanus bacillus, but the results were not encouraging either from the standpoint of treatment or prevention.

During the past year the French have prepared antimicrobial sera against the bacteria causing gas gangrene, namely, the *B. aerogenes capsulatus*, the *Vibrio septique*, the *B. oedematis*, the *B. bellonensis*, and *B. sporogenes*, and have reported good results by the use of these sera, given by simultaneous injection, both for prevention and for treatment. They claim that the incidence of gas gangrene has thus been reduced by five-sixths of what it was formerly, and that in established gangrene the process has become localized.

Let us now consider in more detail the principal points in the treatment of a war wound when it first comes to the surgeon. We have to confess that the progress in the treatment of these wounds consists chiefly in the emphasis and generalization of principles which were already practiced before the war, although perhaps, in the case of some surgeons, subconsciously. We have also learned that these principles can be applied successfully much later than we used to suppose was possible, namely, wounds in which infection has become established.

In the early months of the war, during the period of movement and before the transport of the wounded became organized, it was the exception for a wounded man to reach the operating table before several days had elapsed, and consequently infection was in full swing. The operation then was essentially a débridement, which consists in laying open the wound sufficiently to drain all pockets and to remove foreign bodies and loose ends and shreds of tissues, including detached fragments of bone. Drainage was effected in various ways. Such an incomplete treatment naturally created a demand for some method or substance to combat the terrible infection persisting in the wounds. Thus, in spite of conviction as to the undesirability of antiseptics on the part of at least some surgeons, all had recourse to every known antiseptic, one after another, and actually the old antiseptic era of surgery was revived.

During the winter of 1914-15 one of the younger French surgeons, Lemaitre, commenced to systematically surgically cleanse the wounds which came to him within a few hours of reception and close them immediately. The results were extremely satisfactory, and this treatment became generalized throughout all the armies in the year 1917. The operation consisted in paring off the entire surface of the wound, sparing all living tissue, but removing all devitalized tissue and, of course, all foreign material. The operation is termed *épluchage* (literally paring or peeling as applied to the preparation of vegetables). The paring is followed by a most careful, punctilious hemostasis, which Lemaitre followed by an application of iodine. The wound, if the patient is to remain under the observation of the operator, is then carefully closed layer by layer, all dead spaces being obliterated. Many surgeons insert strands of silkworm gut to serve the double purpose of drains and telltales, they being removed at intervals and cultured. Valuable information is thus obtained in determining whether the wound should be reopened in case of infection. Obviously, such an operation requires long incisions, but does not necessitate removal of more than the mere edges of the original wound. The common error of enthusiastic and inexperienced surgeons is to excise wide ellipses of skin. As I have said, the wound is closed when the patient is to remain under observation. When the patient is to be evacuated before 10 days have elapsed after the operation the wound should not be sutured, because continuous observation is interrupted and accidents may occur.

Judging from the patients who have come from our evacuation hospitals, there is still ignorance, or at least doubt, as to how an *épluché* wound which is not closed should be treated and dressed. Many are packed with dry gauze, necessitating an anesthetic for removal, and not infrequently damming up infection at the bottom of the improperly and insufficiently treated wound. In many of such cases one or two days en route full-blown gas gangrene has been observed. Other operators use paraffined or vaselined gauze; others antiseptic substances such as dichloramine-T. The rational method is, if the operation has been complete, to insert some strands of silkworm gut and let the surfaces of the wound fall together, laying a dressing of dry gauze flat on the surface. If clean, the wound will in all probability close and may not need a delayed operation. If it becomes infected there will be no obstacle to drainage.

Wounds that are closed immediately at the first operation are said to have undergone primary suture, the term "delayed primary suture" is applied to the closure of a wound at a second operation within a variable period, but not one requiring repairing or revivifying of the wound. The term "secondary suture" is applied to the operation, usually upon a granulating wound, in which the surfaces of the wound are removed. Generally in secondary suture a plastic operation on the skin is necessary.

Successful primary closure of wounds complicated by fractures is much harder to obtain than of those of the soft parts alone, on account of the difficulty of removing contamination on and between the fragments of bone. This difficulty has led to extensive resection of the fragments, a procedure which should be condemned, for although extensive reproduction of bone usually takes place if the fragments are resected subperiosteally, yet the period required for union is prolonged, and, not infrequently, pseudarthrosis results. Furthermore, it frequently happens, if the operation is not successful in preventing infection, that necrosis of the ends of the fragments occurs, thus defeating the object of the resection. The opinion, at the present time, of the most experienced surgeons in all the armies is that, while all absolutely detached fragments should be removed, the greatest conservatism should be exercised in regard to those remaining attached to the periosteum. Soiled portions of these should be cut away and just enough of the fragments removed to permit inspection and cleansing of the marrow. In regard to the latter it has been determined that it is very rarely contaminated for more than 8 to 10 mm. beyond the line of fracture. It is very important to remove this terminal pulpified portion, for it is frequently found to contain minute shreds of clothing torn from the patch on the missile.

If fragments of bone have to be resected the long ones should be left, in order to preserve the continuity of the shafts. As has been said, in fractures caused by simple contact of the missile, resection is not necessary and the wounds complicating them may be closed as if of the soft parts alone. When fractures are caused by missiles which perforate the bone, whether they lodge in the soft parts beyond or pass entirely through the limb, it is usually advisable to operate from both sides of the limb, because the damage to the soft parts is generally greater on the far side of the bone and because less traumatism is done to the site of fracture. In regions where loss of bone is structurally unimportant, and where infection is disastrous, as in the case of the cranium and the ribs, it is wiser to resect liberally. Internal fixation in fractures of war is bad practice. It provokes necrosis and is unnecessary.

In speaking of the indications for and the contraindications to primary suture of wounds, I wish to say a word in regard to wounds caused by rifle balls. It would seem almost superfluous to state that a perforating rifle-ball wound with a punctate orifice of exit does not require an operation, yet in one of our hospitals the staff was carefully débriding these wounds and allowing other wounds caused by shell to wait. As I have already indicated, the size of the wound of exit is a pretty accurate measure of the damage done to the deeper parts; consequently, when the wound of exit is small, an exploration is more than likely to cause greater damage than already exists.

Rifle balls when they produce a bursting effect cause terrible damage to the muscles, and the worst examples of gas gangrene occur in these cases; consequently these wounds must be thoroughly epluched. Yet a bullet rarely entrains infectious material, the probability being that these wounds are not contaminated from within, and therefore must be infected from without. It would seem reasonable to use iodine freely about such wounds when putting on the first-aid dressing and to protect them carefully. As you know, iodine has been removed from the first-aid packet on account of its inefficacy. I imagine that its supposed inefficiency came about from its use on shell wounds which contained infectious foreign bodies. During the period of trench warfare most of the wounds were caused by shell. Lately a large number must have been caused by machine gun and rifle, and some method of preventing their becoming infected would be of value.

As I have already stated, the application of the principles of épluchage and primary suture has been considerably extended, and now many wounds 36 to 48 hours old are being thus treated, even in the presence of redness, a seropurulent discharge, and a febrile reaction—thus proving that the earlier opinion that wounds could not be sutured primarily when more than six to eight hours old is erroneous. In regard to this point, it is impossible to formu-

late rules to cover every case. The question whether to do a primary suture or to wait for a delayed primary or secondary suture must rest for the surgeon to decide. It is better for the inexperienced operator to err on the safe side. But there are other conditions and circumstances in the presence of which we know primary suture is unwise, if not actually dangerous. These are, first, when the patient can not be kept under the observation of the operator for 10 days; second, in periods of congestion of the operating room with wounded; third, when there is doubt as to the thoroughness of the operation; fourth, in fractures of the upper part of the humerus, the shoulder, the pelvis, the hip, and upper part of the femur; and, fifth, in large wounds when the principal artery of the limb is ligated. The danger of suturing the last two classes of wounds is chiefly from gas gangrene. Delayed primary suture is always a possibility except, perhaps, in some wounds, such as deep wounds of important regions, where it may be anatomically impossible to lay open the wound sufficiently to remove its surface. In these cases one has to be satisfied with as free drainage as possible.

Simple incision, removal of foreign bodies, and drainage is insufficient for cases of gas gangrene. These cases must be radically treated—the muscles affected must be removed until healthy contacting muscle tissue is reached. Sometimes an entire muscle has to be removed. The wounds should be left widely open. If an entire group of muscles is involved, amputation is safer than excision. If the main artery of the limb has been destroyed, amputation should always be done.

Let us now turn to the treatment of wounds of the articulations. The experience drawn from the war has changed our ideas greatly, both in regard to the susceptibility of the synovia to infection and as to methods of treatment. The most striking developments have been the Wilhelm's treatment, which is, essentially, the continuance of the function of the joint during treatment. In the case of a wound of the knee or ankle, the patient is made to walk each day, even though pus escapes from the wound at each step. The active motions must be commenced immediately after the operation and repeated several times a day. If the treatment is delayed, motion of the joints is so painful as to be impossible. By this treatment functional results are obtained which by any other treatment would be unattainable, since the maintenance of function seems to conserve the cartilage.

Primary closure of wounds of joints is extremely successful, even when foreign bodies have rested in the synovia for comparatively long periods. However, if a wound of the cancellous tissue of the epiphyses becomes infected and it can not be isolated from the joint, the latter is doomed to suppuration and usually destruction. The rule, therefore, in penetrating wounds of the joints, is to close the synovia and drain the bone wound exteriorly. Attention has already been called to the difficulty of combatting infection of cancellous tissue, and likewise to its persistence. Consequently, in the case of the weight-bearing articulations, such as the knee, a typical resection involving removal of the contused and presumably infected bone is indicated when the architecture of the joint is destroyed by loss of bone. In the upper extremity, typical resection is rarely indicated. Dead cartilage prolongs suppuration, as repair can not take place until it is eliminated consequently its early removal is often indicated when a typical resection is not done.

In regard to the drainage of a suppurating joint, no through-and-through tubes should ever be employed. Tubes have to be employed in the case of the deep joints, namely, the hip and shoulder. In the other joints free gaping incisions usually suffice, together with removal of the loose fragments of bone interfering with drainage or liable to necrosis. Where there is no injury to the bone, free incisions and early active motion are indicated. Metastatic joints often are cured by repeated aspiration and washing through the aspirating needle. Resection sometimes saves a limb which otherwise would have to be amputated.

I shall not attempt to burden you with the indications for resection of the different joints. It would take too long, and besides it is not within the province of my subject. I do wish to mention some points in regard to amputations.

In the first place, the whole question of the sites for amputation in the lower extremities depends upon the fitness of the stump for an artificial limb, with the exception of some of the anterior amputations of the foot in which no apparatus is required. In regard to the tarsal and tibiotarsal amputations, I do not think that it has as yet been determined whether the stumps are more practical than those of the amputations through the leg, given the excellence of the modern artificial limb applied to the latter.

In the case of amputations of the thigh there is no question as to the desirability of as long a stump as possible. In fact, an artificial limb for an amputation above the middle is impractical for the average man.

When a guillotine amputation is done, the final result is a stump which is almost without exception too short for an artificial limb. I believe also that drainage after the guillotine is no better than that after a flap amputation made with a long anterior flap. In the latter the anterior flap falls over the end of the bone and protects it to a certain extent, the drainage being dependent. The flap should never be turned back. Neither is there any reason for traumatizing the stump by filling it with gauze. Secondary amputation is the rule after the guillotine and the exception after the flap amputation.

A recent and, I believe, valuable point in the technique of amputations for suppurating knee joints is to make a long anterior flap including the patella and divide the soft parts behind the knee without touching the bone. In a short time the wound is clean and fit for secondary suture, when the condyles are removed and in some cases a Gritti may be done. This operation has the great advantage of not opening new channels of infection in the bone at the primary amputation as well as causing little or no shock.

It is a good rule never to amputate the upper extremity for lesions of the bones. Amputation is only indicated by extensive destruction of the soft parts—muscles, vessels, and nerves.

In the case of injuries to the metacarpus and fingers, it is wiser to do plastic amputations with a view to eliminating infection and thus preventing irremediable stiffness of the uninjured fingers. For example, if a metacarpal bone is fractured and the tendons of the corresponding finger are destroyed, the metacarpal and finger should be resected, always leaving the proximal extremity of the metacarpal to avoid opening the carpal articulations. In other words, fingers which will undoubtedly be stiff should be removed at the primary operation in order to eliminate infection and to obtain rapid healing and, therefore, an early return of function in the remaining digits. The only exception is the thumb, every portion of which should be conserved.

Army Sanitary School No. 164.

WOUND BACTERIOLOGY

By Capt. B. Jablons, M. C., United States Army, November 26, 1918

Wound bacteriology has developed into a special science as a result of the extended investigations of the past four years. As its name indicates, it deals with the study of the bacteria that infect wounds and by their evolution interfere with the healing of wounds or menace the life of the patient. The aseptic or operative wound of peace times differs from those caused by gunshot injury in that it is the seat of comparatively little traumatic destruction and contains no infective bacteria. The war wound, on the other hand, is characterized by extensive destruction of tissue, with widespread implantation of numerous bacteria by the projectile inflicting the injury. The determination of the type of the bacteria as well as their location helps the surgeon to decide upon measures to be adopted for the conversion of the infected war wound into an uninfected aseptic operative wound, and thus facilitate the physiologic healing. The convalescent period may be thus markedly shortened, and men enabled to return to their respective units in 15 days to 3 weeks instead of being bedridden as formerly for many months.

The evolution of the subject is of interest. The attitude toward gunshot wounds during the Balkan wars of 1912-13, the only recent wars preceding the great World War where modern projectiles were used, was a very conservative one. Gunshot wounds were considered relatively sterile. Infection was usually thought to be secondary and not due to the projectile. Bullet wounds were considered to be uniformly sterile and all operative measures were considered unwarranted where active infection was not present, so much so that a great deal of discussion followed the attempt of several surgeons to probe and remove bullets or other foreign bodies. Shrapnel shell wounds were treated by local application of iodine or other antiseptics, and covered by Matisel dressings. The attitude of most surgeons was that nature's barrier must not be interfered with, and the necrotic tissues

must be allowed to slough off of themselves. If no fracture was present, occlusive dressings were applied. Occasionally the wound was irrigated with hydrogen peroxide preceding the application of the dressing. If a rapidly progressive infection developed, radical amputation of the limb was resorted to. There was a difference of opinion as to the proper treatment of wounds of the abdomen or lung. As a general rule little intervention was practiced in abdominal wounds. It was thought that nature would accomplish all that could be accomplished, if a fatal peritonitis did not occur immediately. As for wounds of the lung, these were treated by means of occlusive dressings, and when empyema developed extensive resection of the ribs for further drainage was the usual operative measure.

The early days of the European war saw no change in this attitude. The same views obtained then as were current during the Balkan wars. The results obtained were so disappointing that many surgeons began to use the more powerful antiseptics, and insisted that war conditions made it necessary to return to the treatment advocated by Lister. Cauterization with carbolic acid, irrigation with formalin solutions, and the use of other strong antiseptic agents became then the accepted methods of treatment, with removal of some of the foreign bodies present in wounds. It became very apparent, however, that this was not sufficient, and not a few investigators began extended researches into the nature of wound infections and the best methods that could be devised to overcome the extensive infection of wounds. Carrel was one of the foremost of these investigators, and was prompted to undertake these studies as a result of his unsuccessful attempts to transplant limbs from human to human owing to the extensive infection present in the tissues around the wound. While looking into what was being done at the American ambulance of Neuilly to control wound infection, the use of eau de Javel as a wound antiseptic attracted his attention. This antiseptic had been employed some 50 years previously by a French surgeon, but had fallen into disuse, until Doctor DuBouchet reintroduced it at the American ambulance hospital with some remarkable results. The patients, however, complained of the marked irritation which accompanied its use, the pain following its application being almost unbearable. Carrel set about to look for a modification which would conserve its antiseptic properties, but which would be nonirritating. He had Dakin come from the Rockefeller Institute to work on this problem and to investigate the bactericidal effect of these different solutions. The result of these researches are now well known. In order to control the progress of wound sterilization, Carrel adopted the plan of counting the bacteria present in the exudate of wounds, and by charting the results obtained the so-called Carrel bacterial curve. It was thought that when the count reached a certain low level that wounds could then be safely closed. At about the same time researches into the histological nature of wounds demonstrated that wound margins were almost always necrobiotic, and in many instances were heavily infiltrated with foreign particles; and that wound healing was markedly retarded because of the necessity for preliminary sloughing of these tissues. Some surgeons, among whom Lemaitre was active, suggested excision of the wound margin, combined with antiseptic treatment of the wound. It was only a step from both of these procedures to secondary closure of the wound. It was soon found, however, that many of these wounds refused to heal, or would develop rapidly fatal or progressive infections despite the excision of the wound margins or a very low bacterial count. It became, therefore, necessary to carry out more extensive and more thorough bacteriologic investigations to explain these failures. As a result of these investigations it was found that certain bacteria did not interfere with wound healing, but that others, either because of their proteolytic ferments or toxins, destroyed tissue cells or produced a toxemia which markedly affected the outcome of the wound.

This is what has led to the development of wound bacteriology as a special study and indicates its importance in the scientific control of wound surgery. Wound infection depends closely on several factors which are responsible for wound production. The factors of greatest importance are naturally the substance inflicting the trauma, the bacteria which it introduces into the wound, and the energy which it transmits to the tissues that it injures. Other factors of secondary importance are the types of tissues that are affected, the local resistance of these tissues, and the physical changes resulting from the injury which may favor bacterial development.

In general, the wound itself varies, depending whether it is produced by regular or irregular missiles, or whether the energy transmitted to the tissues is that accompanying primary or secondary projectiles. A detailed discussion of these factors will be taken up under the chapter on ballistics. The bacteria that are introduced into wounds varies, depending upon the sources from which they are derived. The projectile may have been primarily contaminated as a result of handling or by being in contact with the earth. It may become secondarily contaminated as a result of its passage through trench earthworks or by contact with the outer clothing of the soldier, which is almost always contaminated by soil. A habit of some soldiers, that of spitting on bullets or other projectiles, is responsible for the introduction of mouth bacteria into the wound. Its passage through the skin enables it often to carry shreds of the skin into wounds, with their contained bacteria. This means that the wound is often infested with the innumerable varieties of microorganisms found in the soil, usually derived from the excrement of man or animals, as well as the common mouth or skin bacteria. Not all of the bacteria introduced into wounds are capable of development, as other factors are necessary for their further development and multiplication. Examination of the wound contents would show a very varied flora during this stage, but would in no way indicate which organisms are going to interfere with wound healing or menace the life of the soldier.

Following a latent period, which seems to be the same in all wounds, certain bacteria develop, depending upon the type of tissues injured. Muscle tissue furnishes the protein and sugar which favor the development of certain bacteria of the saccharolytic anaerobic group over other bacteria which may have been carried into the wound. Wounds associated with extensive injury to blood vessels favor the development of the streptococcus group of bacteria. Wounds of bony tissue favor the development of the *Staphylococcus aureus* group of microorganisms. This early type of wound infection is usually spoken of as the selective type of infection. The organisms which appear later usually represent bacteria that have adapted themselves to the conditions present in wounds and which have been able to find a sufficient amount of nourishment to maintain themselves during the period of adaptation. Other organisms may extend from neighboring parts or localize in the wound after having penetrated into the general blood stream. This constitutes secondary infection and is subdivided into adaptation and metastatic infection.

A type of wound infection that deserves special consideration is the mixed infection of wounds. The importance of bacterial association in the production of infection has been known for some time. Its importance has been more generally appreciated as a result of the numerous investigations of the past four years. We now know that certain bacteria are capable of increasing enormously the virulence of associated bacteria, and are also capable of hindering the development of other bacteria. The former is a malignant symbiosis, whereas the latter is a benign type of symbiosis. Thus the *B. sporogenes* is capable of increasing the virulence of quantities of *B. Welchii*, which alone are incapable of producing any lesions whatsoever, while virulent quantities of the *Vibrio septique* are rendered comparatively avirulent when associated with the same organisms.

The importance of another type of infection occurring in tissues has been appreciated due to the prolonged observation made possible during the present war. Due to a secondary trauma, or other factor capable of lowering the resistance of the individual, bacteria implanted at the time of the initial injury may develop some time after the infliction of the wound. This has been known to occur several months and in many instances even years after the original wound. The importance of latest infection is not to be underestimated, as it contributes very much to the production of dangerous sequelae.

The bacteria that have been reported as occurring in war wounds may be roughly subdivided into saprophytic and pathogenic. This classification, although a classical one, is not a very good one, as the experience of the last few years show that saprophytic or non-pathogenic, is only a relative term since many of the so-called saprophytes are capable of becoming pathogenic under favorable conditions alone or when in combination with other nonvirulent organisms. We prefer to classify these organisms into aerobic and anaerobic, although some of the aerobes are likewise facultative anaerobes.

The most common aerobes found in wounds are:

Gram-positive cocci:

Staphylococcus group.

Streptococcus group.

Diplococcus group—

Pneumococcus.

Enterococcus.

Diplococcus griseus nonliquefaciens.

Gram-positive bacilli:

Endosporing bacilli—

Bacillus subtilis.

Bacillus anthracoides.

Bacillus mesentericus.

Bacillus mycoides.

Corynebacterium.

Bacillus cutis communis.

Bacillus diphtheriæ.

Gram-negative bacilli:

Saccharolytic—

Bacillus coli communis.

Bacillus Friedlander.

Proteolytic—

Bacillus proteus.

Bacillus pyocyaneus.

The most common anaerobes are:

Toxic group:

B. Welchii.

Vibrio septique.

B. tetani.

B. adematians.

B. fallax.

B. histolyticus.

Proteolytic group:

B. sporogenes.

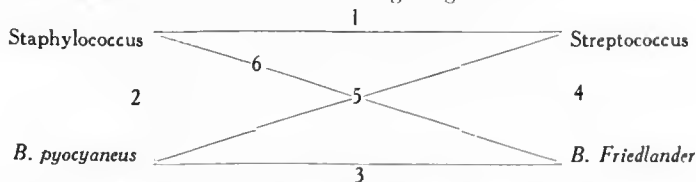
B. putrificus.

B. bifermentans.

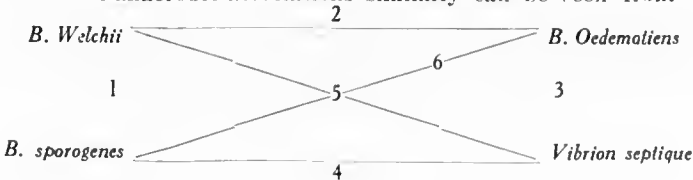
B. ærogoetidus.

Nonpathogenic: *B. tertius*.

These bacteria have been reported in wounds sometimes alone and sometimes in association. The most common associations are aerobic associations, although in the gangrenous types of wound infections anaerobic associations are most common. The most common aerobic associations can be seen from the following diagram:



The most common anaerobic associations similarly can be seen from the appended diagram:



We have gotten up a chart for the purpose of teaching the subject at the central laboratory, which subdivides the organisms, first, whether they are aerobes or fall into the coccus group; whether they are aerobic bacilli and those which are Gram negative and those which are Gram positive. An attempt has been made to study bacteria, not only with regard to certain characteristics, but to look at them from a biologic basis to determine the type of reactions which a given bacterium is possible of manifesting when put into different environments. So we study the bacteria on the basis of morphology, their ability to split sugars and their ability to ferment or split protein substances, their ability to break up peptone, and their characteristics. In other words, their ability to produce bodies when injected into the human organism. The Friedlander and colon bacilli are more dangerous because they split carbohydrate substances, and wounds that show an absence of gas bubbles may be any of the group which are sugar-split bacteria. The proteoses digest protein substances, and this interferes with wound healing.

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INTERNAL MEDICINE IN THE ARMY

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We are all here to say something in regard to internal medicine in the American Expeditionary Forces. I am going to start by saying a few general words about the function of the division of medicine. I don't think anyone in this course has explained to you exactly what the three divisions of the professional services are.

In the first place, in times of war, officers of both the Army and Navy have been called "surgeons," and the explanation is suggested by considering "battle field," "dressing stations," "transportation of the wounded," and so forth—just a military proposition. This is the picture that comes immediately to the mind of one who thinks of war, and quite naturally, as shells bursting, opening of wounds, amputation of limbs, and so on, as the main function of the Army medical officer. But in all modern wars before this—and it will probably be so in this war, although perhaps not so up to the present time—the greatest loss of men has been from disease rather than from wounds; and if our duties are to preserve the man power of the Army certainly the medical side of our functions, more properly speaking, are not less important than the surgical. In the moment of battle certain purely surgical and administrative propositions come, it is true, overwhelmingly to the fore. Some one said the first important duty of the medical officer is the prompt evacuation of the wounded, and at certain times that is unquestionably true. But how much of the time of soldiers is spent in actual combat? The great bulk of the time is spent in preparation of men and material, and on this preparation and the conservation of these men and this material the outcome of the battle and the war itself depends. The functions of the physicians in private practice are often summed up as consisting in the prevention, the early detection, and care of disease. But there is one other function which outweighs all these. The greatest influence for good that the physician exercises in his practice is the mental and moral influence on the patient, his personal influence. He can do much toward preventing disease, and in treating disease, but far more can he do in fortifying, cheering up the patient and the men in his command.

The medical officer in the Army can do much toward preventing disease by attention to the sanitary regulations, the cleanliness of the troops in his command, but in the region to which he is attached he can save much trouble by the early detection of disease. Upon the medical officer as much if not more than the character of the battalion and regimental surgeon much depends. The position of a battalion or regimental surgeon is a position of danger and one of honor, a very real position of honor. I don't know that I can better illustrate this than by speaking of two experiences I have had over here. Two of our men who graduated in the last 10 years from our school of medicine came over before we came into the war to work with the British. One of them—I don't think it is any harm to say—was a nephew of General Gorgas, a very exceptional man, who occupied an important position in the school of medicine in which he was teaching; he had very unusual qualities as a laboratory worker, and when he spoke of coming over everybody told him he was doing the wrong thing, that there were very

few men who could stay and do the kind of work he was needed to do in the school. But he wouldn't be stopped, and finally he went to see General Gorgas and he seriously told him it was no place for him; that his duties were at home, that he couldn't go, and so on. The young man listened most patiently, and said: "Uncle William, if you were in my position what would you do?" and the general laid down immediately. He went over; did exceedingly good work for the British; got a decoration. As we came over he was needed very much in the laboratory department; we couldn't get men of his type for work there. It took Colonel Siler three months to get him out of Italy. He was still with the British Army; he was a regimental surgeon with the British Army in Italy in active work. We finally got him to the laboratory department and he stayed there about two weeks. The man felt so strongly that his proper position was one of battalion surgeon, that was the place where he could do the most good and was most needed, that he couldn't stay in the laboratory, and finally Colonel Siler let him go, and he went back.

The other man was another man of a similar type. He came over to work with the British, and when the American Expeditionary Forces came over he was taken out of the British and put in a hospital where he belonged. He was a man of special medical training more than laboratory training. I wanted to put him in charge of a medical service, and he came and talked to me the same way. He said that he did not want to do that kind of work; that he felt that his position, the place where he could do the most good, was as battalion surgeon. That one could do more for the good of the service around there by setting the example there than he could in any other way. Finally, very reluctantly, we let him go.

Within the month I have been down the line to the base hospitals. At Nantes, I think it was, I came across a man and asked him what division he was in, and he told me, and said: "I was sent into the hospital by Captain So-and-So"; and he smiled and said: "Do you know him?" I said "Yes." He said: "There is nothing that the men in our regiment wouldn't do for that man; he is perfectly wonderful." He said: "Do you know where he made his dressing station on such-and-such a day? He made it in the second-line German trenches. One day he came into our company kitchen and he said 'That's a nice looking kitchen. There's \$10 for the best kitchen in the regiment this month; and you ought to see those kitchens shine.'" Well within two weeks, at Limoges, an officer said to me "I wonder if you don't know So-and-So?" I said I did. It was the other man. He said "He is the most extraordinary man. Do you know, he knows the regiment. He is the regimental surgeon, and on the march he is going steadily from one end of the regiment to the other looking for men who are falling out, looking out for everything. He knows everybody and more than that he knows everything, and if the regiment loses its way he finds the way. He is a most extraordinary person."

That shows what a regimental surgeon can do, and it brings to mind something that a major general said to me not long ago. He was speaking of the necessity for divisional rest camps so as to prevent the men slightly ill, when they are merely tired, from getting way down the line of communications and getting away from the division. He said: "What I want is not only a good medical officer to take care of the men but I want a medical officer who can tell me to look out for the men and find them out before they get away. I want him to say, 'Such and such an officer is about ready to break.' Then we can save him." That is where the regimental or battalion medical officer comes in. It isn't only a question of the personal influence on the men, but there are many other things of great importance there because of his close relations with the men. It is on the regimental and battalion surgeons that the prevention of little epidemics that are extremely annoying sometimes depends more than anyone else. Keeping up the sanitation of his detachment, he may do much toward preventing dysentery, typhoid fever, which despite our vaccinations crops out here and there, and may crop out more seriously before we know it. If he keeps in touch with his men properly, he will pick up diphtheria in time to stop it and stop the spread of young epidemics, not to speak of other infections of all sorts which our new replacements coming over from America are bound to bring over and which will crop out from time to time; he will detect men when they are worn out, when they need to go to a rest camp, when they need to be taken out of the line for a little while; the detection of such things as early tuberculosis, etc. The detection of early tuberculosis may seem a rather foolish

thing to talk about in active warfare, but Major Webb, who is looking into tuberculosis work here, brought out something. As you know, a year ago last summer all of our Army was gone over rather carefully by competent committees of specialists on tuberculosis and we weeded out something over 1 per cent, and the men we have over here have been a very fine set and there was very little tuberculosis. It was well weeded out, but, as Webb says, the weeding out of tuberculosis is a good deal like weeding out a garden—after a little while the weeds come up again. And the time when tuberculosis is going to come up is in the course of the next six months, after these divisions have been worn out through great exhaustion; it will come out unless I am much mistaken, and it will have to be looked after. Already the tuberculosis that is coming from the divisions is much too far advanced to be creditable to our "Medical Corps." I say the "Medical Corps" in the broad sense, of course. There are very few cases, but a good many of them have gotten far advanced, and I think a good deal of it is because the regimental and the battalion surgeons haven't known their men, haven't followed the men, haven't looked after them. Now, to pay attention to a few men, you may say, is a small thing when so many more are sacrificed in other ways. There is another side that may be a material side that I never thought of until Major Webb spoke of it, and that is—he said if we don't look out for that few in the course of the next six months, if we don't go through these divisions again and look after things, there will be trouble after the war. There is one thing that the public is more interested in than anything else, and that is tuberculosis. When the men are brought back from this side, I find that in New York the one thing that the people are interested in was the poor T. B. patients. They are more complaining than anything else; they have nothing to do but complain of the way they were neglected. And, as he says, we shall have a congressional investigation on the way tuberculosis was managed in the Army. These cases can be picked up early if the surgeon makes careful inspection of things and his men. He shouldn't leave it to his sergeant; he should do it himself.

Another thing that Colonel Ashford spoke of some time ago is the relation of those officers to the question of gas, a question very few of us knew much about when we came over here, and it isn't in the stress of active work that we ought to learn about it; about its destruction, and who is and who isn't gassed, and who shall be evacuated on a stretcher and who not. These are extremely important points, and much depends on the regimental surgeons and the men in the field hospitals to determine who is and who isn't gassed. These questions need careful attention, careful study, and careful training. The proper distinction between the gassed and the merely tired is a thing that hasn't been mastered very well. There are lots of tired men that have not been gassed, yet have been sent down as far as Nantes. I don't know why they were evacuated, as they were just tired.

In aviation units the duties of the medical officer are of vital importance. It is true the officers for the aviation units ought to be specially trained, and they will be, I think, in the future; but the main thing is to detect the early evidences of strain in the aviator. It is probably safe to say that the majority of fatal accidents that happen in the Aviation Corps have been caused by men flying when they ought not to fly and when a proper relation between the medical officer and the line officer and a proper attention to duty on the part of the medical officer might save the men. Aviators show certain symptoms of strain and exhaustion which the medical man should learn to detect, and one of his most important duties in an aviation group is to detect; but above all, as I said a moment ago, the medical officer in the battalion and regiment is important because of the personal influence he has on his men. Nothing strengthens the men's morale more than to know that the surgeon is with them, going over the top with them, is by their side to help them. This is really almost the most important part of their work.

In the field and evacuation hospitals again the medical personnel is—I say "personnel" because the officers must often act as both physician and surgeon—but they have especially two important functions, with the care of the gassed and the care of those suffering from surgical shock. Now, every officer in a field or evacuation hospital should make it his duty to familiarize himself so far as possible with the proper methods of the care of gassed. Hereafter in our divisions we will have a medical gas officer whose duty it will be to see to it that the medical personnel is well instructed, well up in these matters; that instruction is given,

and that proper attention is paid to the instructions. Arrangements are now being made for a sufficient amount of literature to give the officers an opportunity to learn. Every officer should make it his duty to see that he is familiar with the methods of treatment of surgical shock, for surgical shock is going to be treated largely by men who do not operate but who are medical men, in order that every man capable of operating may take over that side of the work. In the field hospital every officer may not be able to take the contemplated course in surgical shock given at Dijon, but others in his unit will have had the course, and is his business to learn from them. We are in this war to win it, and there is no excuse for a medical officer sitting down in ignorance and not trying to find out about his job. There is nothing so encouraging, as a rule, to a superior officer as to find an inferior who says he doesn't know but wants to find out. In camp and base hospitals also the medical officer should seek to prepare himself in regard to the treatment of surgical shock and gassed cases. Evacuation sometimes in the advance base hospitals is fairly rapid. Evacuation to hospitals as far as Limoges is such that oftentimes within 48 hours he may be in hospital still showing symptoms. Literature—and more and more as time goes on—will be available in base hospitals in regard to gas. Ask for it. If it isn't on hand, the commanding officer will be able to get it for you. Some of it is here; more is coming.

In base hospitals there may be and there has been—there was last winter for those who were here—considerable periods of time in which not much is going on. These are times in which a man may prepare himself for the special problems which he may have to meet; for the officer who desires really to make himself efficient there isn't very much time to spare, even when the hospital is relatively empty.

There is one other class of work of extreme importance, the importance of which is far from being realized, and that is the board work, the S. C. D. boards. These boards to properly do their work must consist of exceedingly good men, must consist of the best men that can be gotten hold of, and the work can not be done hurriedly and at the same time be done well. It is very interesting to see, in crowded hospitals with an insufficient personnel, cases that are boarded and boarded two or three times. It is interesting to see how easy it is to make mistakes and how many things slip through. In board work one gets used to dealing with soldiers who one suspects of malingering or attempting to malingere. In this Army it is very different from what it used to be in the old Army; different types of boys here. It is a serious matter sometimes to send away a common soldier; often a very grave and serious matter to send away an officer, upon a mistaken diagnosis. Major Cohn will speak of that. The most serious mistakes are made in diagnosing cardiac diseases. Now, it is really surprising the proportion of cases in which heart disease is wrongly suspected by S. C. D. boards. If an officer of the S. C. D. board doesn't know that systolic murmurs don't necessarily mean mitral insufficiency he ought to get busy, get a hold of some man in his unit who has had that training and learn some points on the examination of the heart and the significance of functional murmurs. The majority of people under 30 have a systolic murmur at the apex of the heart in a recumbent position—perfectly healthy people. There are an awful number of persons who are recommended for retirement with nothing under the sun the matter with their heart, simply because of the presence of certain murmurs.

Again in base hospitals, as in advance formations, the attitude of officers to the men is highly important, especially in dealing with the neurologic and the exhausted. Few reserve officers, or officers who have come up from the Reserve Corps recently, who haven't seen it over here, can realize the importance of discipline in dealing with men in base hospitals. The discipline of a group of pretty good soldiers will go absolutely to pieces in a few weeks as they pass through base hospitals if it isn't attended to. They become loose, shiftless, good for nothing, and go all to pieces. It is absolutely important to keep up good discipline and to make the men remember that they are soldiers. It is equally important to remember that the keeping up of good discipline is an entirely different matter from lack of discipline. Discipline is something that one can not afford to forget. Neither can one forget to show the proper consideration, proper sympathy for an ill man, but we can not afford to be quite so free and easy in a ward in a base hospital as in a ward in a civil hospital. You have got to remember that you are an officer and the patient is a soldier. Don't let the men go to pieces as they go down the line.

The functions of the officers in convalescent camps which are growing and will grow to more importance will be spoken of by Major Cohn. There, the problems are fascinating, complicated, and I will only say here what some of us heard an English officer say—that they began in the British Army assigning to convalescent camps the older men less able to stand active work and who were, perhaps, not of a first order. They ended by realizing that the convalescent camp demanded the ablest, most active, and vigorous young men in the service; that it was one of the most complicated, difficult, and serious problems in the Army.

Now, I want to say a word or two about what these so-called divisions of professional services mean and what those of us who figure as consultants are trying to do here. When this war began, or a little before the war began, some of you may remember the very small Army that we had, the small medical service, the two or three rather stuffy rooms in the Surgeon General's Office, wanting in assistance of all sorts. It was necessary that this small group of medical officers should direct and manage and control this gigantic system which is growing up. It has been a tremendous strain, and it is quite extraordinary that it has been managed so well as it has. It has become necessary for that small group of medical officers to take administrative positions to manage this huge machine. It was necessary to hand over all matters of treatment to the large body of civilians who came in through the Reserve Corps and that even the notably skilled surgeons of the Army would be unable to practice their profession in any way because they were obliged to take directing parts. So the whole problem of surgical operations and medical treatment has been handed over to you. It is a tremendous responsibility on both sides. A plan was adopted by which the divisions of the professional services were created, and at the outset a director of general surgery, a director of urology, a director of orthopedic surgery, a director of neurology and psychiatry, and a director of general medicine were appointed, and later they were all organized into the division of professional services, of which Colonel Keller is director, with various subbranches in surgery, medicine, etc., for the various departments. What are these groups doing? They oversee and preside over the practical surgery and practical medicine of this great Army.

The surgical service went to work in a very interesting manner long before, I am sorry to say, the medical division was started. There were established two particularly excellent evacuation hospitals; but in the first place, to go before that, the orthopedic surgeons took up the question of splinting and first aid. That was taken up by the orthopedic branch through the aid of the Scientific Society of the Red Cross, which holds monthly meetings in Paris and brings together the physicians and surgeons of the British, French, and our Army. Certain agreements were reached in the matter of standardization, and the surgeons, for instance, have standardized splinting, and the whole proposition has been taken charge of by the orthopedic side of the surgical staff, and they have endeavored to instruct in each division the divisional personnel in the standard methods of splinting adopted over here. Then there were two excellent evacuation hospitals, No. 1 and No. 2, situated on parts of the front which are still fixed, where a certain, steady amount of war surgery was passing through. There were established several surgical teams who operated steadily, and notable surgeons and consultants were put in there. As new base hospitals came in these surgeons were sent up to these evacuation hospitals and given experience in actual war surgery, which is rather different, very different, from surgery in private life. Then in every base hospital teams were formed—surgeons, nurses, and orderlies, to come up on emergency and take up work, and, now that the fighting is on, these teams are doing extraordinarily valuable work. Additional teams are sent to every evacuation hospital, and to certain field hospitals, to other strategical points to which they may be summoned in sudden emergency, and all that has been done under Doctor Finney. The genitourinary service has done a very remarkable work in controlling venereal disease in the Army, looking up the question of delousing, treatment of seabies, and other questions of that sort. The orthopedic service established a large camp for the treatment of flat foot and other things. There are a good many weak sisters who come over with the Army with weak backs. They have been taken down to this camp and in a good many instances turned out fairly well.

In the same way other departments have been added which are especially looking after treatment in base hospitals and arranging so that eventually there may be special centers for the treatment of special things. That is the general sort of work the surgical service has done.

In medicine we are trying to do the same. For instance, at the outset it became evident that one of the things that we must do was to provide so far as possible for the instruction of personnel in connection with the treatment of the gassed. So far as possible we have endeavored to help in the instruction of personnel; we have obtained literature for them. We are sending men to different divisions whenever they desire it to give such instruction as we can, and together with Colonel Gilechrist we have succeeded finally in bring about the establishment of the divisional medical gas officer, which is going to be an admirable thing. The evolution of the divisional medical gas officer is a rather good example of what a civilian may do in the Army if he is on to his job. Colonel Grissinger had appointed to his division, the Forty-second, a medical gas officer. Before this the division went through their difficulties in regard to gas and they lost a great many men. Accordingly, Colonel Grissinger took out of his division a medical officer who was probably not much younger than I am. He was a captain; I think he was connected with the field hospitals. He took him out because he thought he was a pretty good man and sent him to the British front to study gas. He proved to be a very remarkable man. He had been working as a urologist, and certainly a urologist would not be the man you would pick out to develop into a gas officer. But he made an excellent gas officer. He organized the medical services of that division and now he is the corps gas officer of the First Corps. He did very valuable and very efficient work. I don't know that any man has done as well as Captain Coghlan has done in that respect.

Each of the new divisions will have a man who can get his medical men in shape in regard to the treatment of gas. Early we found that gas attacks then occurring in the fixed line, and were pretty fierce sometimes. The gas attacks were made with projectiles at a certain point and a group of men would be gassed, and we felt it might be necessary to have teams called to the front at any moment to help out in the treatment of gas cases. Such teams could also be utilized in the care of cases of surgical shock. It was early determined that the need of surgeons would be so great that the care of surgical shock should be turned over to the physicians; that is, men not regarded as suitable to do operating. So now we are forming in each organization two emergency shock teams, gas teams, "shock teams," as they have been called. I hope they may be known as "emergency medical teams." In times when trouble is expected these teams are sent to field or evacuation hospitals or collected at certain strategical points, from which they may be summoned in any emergency. Each leader of a team is sent to Dijon where, in Colonel Siler's laboratory, he is given a course by Major Zinsser and Captain Hussey. They have succeeded in getting a standard method of transfusion so that one apparatus is used everywhere, and each one of these teams carries its own apparatus with it, and the central laboratory is able to supply any number to the field hospitals and places where needed. This may be used in an overwhelming gas attack or for the treatment of surgical shock. In that way they are able to relieve the surgeons, and these men, who are especially equipped men in the treatment and care of shock and infusion, can also help in questions of pulmonary disease and other things that may be necessary in active warfare.

The question aviation is one that came up early. It has been a very interesting question. The medical care of the aviator is a special problem. The British early recognized its importance; the French have been slower. We recognized it at home, but it hasn't been developed as yet here. The aviator is living in a region, if he is flying high, where oxygen is relatively scarce. He is under a very considerable strain, and unless he takes special precautions he is going to get worn out. He must, in the first place, be selected with great care as a man who is able to stand long periods of exposure and long periods of oxygen want. The state of the candidates who present themselves for admission to the Aviation Corps are points of great importance. At the present moment; under Colonel Boggs there is being organized a special aviation service, which has not yet taken form altogether, but there will be a special group of men who know the proposition of examining aviators; and the lives of some of our most important men and the efficiency of our aviation service depends very generally upon the conduct of this work.

Major Webb, as I said, is looking up the question of tuberculosis. He has been going about through the different base hospitals, speaking to the staffs, endeavoring to standardize the work in tuberculosis along the special lines which have been adopted by Colonel Bushnell in the Surgeon General's Office, and already matters are taking good shape. These interesting pulmonary infections that have been occurring in the Army have caused a good deal of confusion, and it was discovered that a great many cases of early tuberculosis were sent back home from France that were not tuberculosis at all. Now, all suspicious cases are sent to one or two designated hospitals, where they are disposed of as the case may warrant.

There are now being established convalescent camps in connection with every large hospital group, and in these convalescent camps there will be many interesting cases that are known as the effort syndrome. Cases of tachycardia, dyspnea, which were known in the Civil War as the irritable heart of soldiers, as described by Doctor Da Costa. The special study of these cases includes a certain portion of these individuals who are otherwise lost to the Army or become permanent invalids, and they present numerous interesting problems, of which Major Cohn will speak. Convalescent camps will do a great deal more. They are gotten out of the hospital atmosphere where they will remember they are still in the Army, where the only idea is that they are going back to the front, where they are given the necessary exercises and the necessary training in a carefully calculated manner without their appreciating it, and thus getting them back into the Army spirit and able to go back to duty.

I have nearly finished my hour. These are the main things the medical service is trying to do. We keep in touch with the different services in the different base hospitals, the special consultants in the different group areas, and in the army corps as well. The consultant in a group area is a man who is the link between our office and the different base hospitals; more than that, also the camp hospital as well. He should be a man who knows the medical officers in the area; he is familiar with the conditions in the base hospitals; he is able to get quickly to the corps or divisions who are supposed to keep in touch with the specially qualified personnel for internal medicine, so that if the commanding officer needs more internists we might be able to indicate them to him quicker. We also communicate with regard to purely professional matters with the chief consultant. The consultant in an army corps in the same way forms a link between the chief of professional services and the professional men in an army corps. Working with the corps surgeon and with the division surgeon, this forms again the same sort of a link. I should say that almost our two main functions are the supplying of personnel through our knowledge of the personnel, and the possibility of giving special instruction in special branches where some instructor is needed. They work in this way. In the First Corps, Colonel Grissinger is chief surgeon and Major Swift is consultant. Through him and through the evacuation hospital and the army surgeon he is able to assist the corps surgeon and the division surgeons to determine at just what points these special shock teams are needed in determining just where men may need special instruction in the shock work or gas work; in other words, helping out the professional side of the machine.

So far I feel very much encouraged with the way things are working out. The effort is, of course, purely and simply to increase the efficient service. It isn't an easy thing to work together with a big thing like this. It seems the more striking how smoothly everything is running.

The laboratory services under Colonel Siler at Dijon are doing a wonderful work. They have a central laboratory which is not only the supply laboratory but there the organization looks out for the establishment of laboratories in divisions and other points where they are needed; it looks out for the bacteriologists as well. Courses are given in wound bacteriology and courses in the treatment of surgical shock. Through the department of sanitation, Major Zinsser has done most valuable work in looking into the outbreak of infectious diseases, and with Colonel Siler, I think, will be able to accomplish still more.

This in a way covers the special medical activities in the American Expeditionary Forces. I do want to say one or two words, more particularly to reserve officers, who are entering into army work. It isn't always very easy for a physician who has been perhaps engaged in more important independent work to step out of his practice directly into the machinery of the Army. He finds himself in a position where he is submitting to a discipline which is sometimes rather irksome. He finds himself often under the command of an officer younger

than he is. He instantly sees the way to all kinds of short-cuts and becomes irritated when he can not follow them. He is very apt to be radical on discipline and be a good deal exasperated by what he has to go through; but as he is in the service longer he learns that the discipline and rules of conduct in the Army were not made for nothing, and when he steps into the Army the first thing he had better remember is to keep his mouth shut and not criticize. It goes without saying that every officer you may be put under may not be an extremely wise man, but when you step into the Army you step into something which is a certain definite organization and discipline; we step in to follow the rules, and we can't do anything but that, and a lot of exasperation might be avoided if only we could stop and see how obscure it is, how little the things are that we often stop to criticize and whine about.

The commanding officers of the Medical Department are men whose only desire is to care for the sick and wounded and to preserve the efficiency of the American Expeditionary Forces. We entered into the service. We stepped into a great machine in which we must expect to do our part in the position assigned. Few of us get in the exact spot in which we would like to be, and that's a point that came up yesterday. I said to a man: "What do you think is the most important thing with regard to the strictly medical duties of an officer in the medical service." After some time he said: "Do you know, I think it would be worth while to say something about contentment with your job." Always. Every reserve man that comes over here is disappointed with his job. He wants to be somewhere else. Very few of us are where we would like to be, and when we are there we can't run it as we would want to run it. If we do our level best where we are, without complaint, we shall do the best service for the whole. If we are constantly thinking of ourselves and our own personal comfort and allow ourselves to be disconcerted, discontented, and to kick constantly, we clog the machine; we are not doing our full duty and are putting sand in the bearings of the machine. Work well done may pass unrecognized, but not often, and with all the difficulties, all the inefficiencies of ourselves, and our faults in the past, and those which we shall certainly commit in the future, the officer who gives his full, his whole effort to filling the duties assigned to him will, in most instances, gain his full reward and will be very sure to gain his name in the Medical Corps of the American Expeditionary Forces.

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THE DIVISION ORTHOPEDIST

By Capt. R. O. Blood, M. C., United States Army, November 27, 1918

I am going to take up a little of the work of orthopedies from the standpoint of the divisional orthopedic surgeon and also from the standpoint of the orthopedic work done in the division, over which the orthopedic surgeon has full control and is naturally responsible. The division orthopedic surgeon has developed entirely since our participation in the war. We now have a divisional orthopedic surgeon, or did have during hostilities, with each of the divisions, and that man was held responsible for the condition of the cases when they left the division and held responsible for the treatment of cases within the division, and, of course, that meant a lot of work. There was no surgical man attached to the division and, naturally, the man who was doing orthopedies took up a great deal more of the serious surgical work; not that we did any actual surgery in the division because we did not, but we had the shock cases to treat and a good many surgical conditions which are not truly orthopedic but which are under the supervision of the orthopedic surgeon. It has been my good fortune to serve during my stay in France—something over a year—first, with a field hospital, then 5½ months with the Infantry as battalion surgeon, then with an evacuation hospital, and then with a base hospital, and finally back to my own division as division orthopedic surgeon. So I have been fortunate enough to deal with wounded men from the front where they were injured back until they finally recovered. Our division, as you all know, started its trench experience the 7th of February last. On the 7th of February we entered the Chemin des Dames sector. There we saw quiet trench warfare. They told us before we went up—we were all very anxious to know how active it was—that it was quiet; that they threw over 400 shells

a day. I asked a French officer how quiet that was, and he said: "When they tell you how many shells they put over a day you can call it a quiet sector." They had already told us they put over 400 a day. When the activity is figured in number of shells it is called quiet.

In order to understand the work of the Medical Department and its relation to orthopedic conditions it is necessary to know some of the conditions under which a medical officer works. In trench warfare, the conditions we found in the Chemin des Dames, we had good dugouts and plenty of room to do our dressing under safe cover, also plenty of room for equipment and plenty of transportation to get it there. In open warfare, such as we had at Chateau-Thierry, St. Mihiel, and Verdun, the conditions were exactly opposite. There you had no protection from enemy fire. You had no place to carry equipment except on your men, and the best thing you could hope for is to get behind the shelter of some small elevation and out of sight of the Germans. Of course a great many things have to be taken into account in choosing your locations there. It should always be possible to find such a location within a kilometer of the front, and I think a greater distance for litter carry in the open is altogether too great. That is entirely up to the medical officer and has to be decided after a study of the condition of the ground in which you are working. On the field of battle, while the first-aid treatment is given the wounded man, the cases are practically all orthopedic if the casualties are due to artillery fire. If due to machine-gun fire, as at Chateau-Thierry, we do not get so many fractures but a great many wounds of the soft parts. Wounds of artillery are practically all fracture conditions. At Verdun, in the last offensive in which we took part, just before the end of the war, the wounds there were practically all fractures, a great many compound comminuted fractures of the femur, and of course these required very careful attention. The treatment of a man depends largely on his diagnosis. We sort of accept the opinions of the medical officer who sees the man at the battalion aid station; if he makes a diagnosis of fracture it is very easy for a man seeing him later to pass him through with the original diagnosis without attempting to make any differentiation in or confirmation of the diagnosis. I remember one case that happened at Verdun. A man came in treated for a simple wound of the thigh. The man who was on duty treated him and said, "Simple wound of the leg," and on looking at the man it looked to me as though he had a false joint and on closer inspection we found he had a compound comminuted fracture of his femur, and he had been through three hands and no one had discovered it. The first man made an incorrect diagnosis and no one else had taken the trouble to make a correct diagnosis. Of course, the man was at once put in a Thomas splint and sent back to the rear.

Cases should be diagnosed as fractures at the first dressing station—the battalion station—and there, except under extreme conditions in drives, we should apply our splints. One of the great reasons for the success of our department within the divisional area is, I think, due to the limited variety of splints used, thus making it easy to teach every medical officer and enlisted man during rest period the rapid and proper application of splints. We have limited ourselves to the following: Humerus traction arm splint for injuries of the humerus, injuries of the elbow joint, and upper part of the forearm. Its application is very simple and requires only a few minutes. One mistake frequently made is in bending it to the chest. Up at Verdun I saw a large number of cases not properly splinted, although the splints were well applied as far as traction went. When I was in Paris in September we had one case in there which had been splinted for about three days. It was under extreme rush conditions following the St. Mihiel drive. This man had been splinted very well except for one point, and the pressure on the brachial arteries had cut off the circulation of his arm, and he lost his arm because of that. That was not the fault of the division; it was the fault of the evacuation hospital. I don't see what right the evacuation hospital has to criticize anybody; we see cases of poorer splinting coming into base hospitals from the evacuation hospitals more frequently than I have seen similar cases leaving the division for the evacuation hospital. That is certainly due to carelessness or possibly to the extreme rush of work they are laboring under; but saving this man's arm was worth more care than was being paid to the cases. So the one necessary thing to do with that splint is to put a band extending from the chest below the union of the arm bar where it unites with the circular ring around the chest, through the other axilla, and fastens to the back of the splint at some point. That prevents any chance of this ring coming up against the arm. Another thing that they frequently do

is to put in a lot of wadding, thinking they are going to get a pressure there. Then in transportation you bring the arm down to the side. You might as well stick your fist in there and press the arm down against it. You shut off the circulation. That is poor judgment. You are protecting in one case and hindering in another. So never forget when you apply that splint to tie it down with some sort of apparatus. The triangular bandage is an excellent thing for that. It is just about long enough to tie below and back. But the bandage must be strong and fairly wide so as not to cut into the flesh.

Now the question of injuries of the forearm and hand. We tried to get the Jones cocked splint, which is a very good splint, but it has been impossible to get them in sufficient quantities, and we found that the wire-ladder splint, bent to meet the special requirements of the case, has proved equal or even better, if properly applied, than the Jones splint for wounds of this part of the arm. The wire-ladder splint can always be obtained. It comes in about 3-foot pieces. You can keep them in dressing stations. I think they will be good things to keep in our offices back home. I am going to throw away my wood splints when I get back. You cut it in two, make it just long enough to go from the elbow to the fingers. You can make it any angle you wish. You can put up one in front and one in back—fix it just the same as a plaster. Just fasten it with a couple of strips of adhesive and it works wonderfully. I think that is the only proper dressing for anything below the upper part of the forearm. Of course, you want to carry all these arms in slings.

These are the splints we have been using in wounds of the forearm and arm. It is very simple to teach the application of these splints to your enlisted personnel and to your new medical officers, and get them so they can do it perfectly well and perfectly easy and it takes very, very little time.

Now for the leg. For the leg we use Thomas traction full and half ring splints and the Cabot posterior wire. The Thomas full-ring splint has been rather difficult to get and has been taken up generally by the bases. In the last drive we were not able to get as many Thomas full-ring splints, so we used the Thomas half-ring splint. It is much more convenient to carry. It takes up a great deal less room and is not so apt to be broken as the full-ring splint. I would advise that it be used entirely within the divisional area simply because it is lighter, easier to transport, and it is practically as efficient for divisional work. The great advantage of the full-ring splint over the half-ring is that it is a little better provided and you can slip it well over the leg. It is a little bit firmer than the half-ring. The uses are the same, of course; injuries of the hip joint, injuries of the shaft of the femur, injuries of the knee joint, of the upper part of the leg, and also for large wounds of the soft parts. It has been proven that, even if you haven't a fracture of the bone, the man is more comfortable and you get better results. If you have a large wound of the muscle of the thigh, for instance, if you apply the same sort of dressing without any splint, and then over that apply the splint, the splint has a tendency to hold the muscles relaxed and keeps the part from moving; the moving, of course, is what hurts. The three important points of the application are, first, the proper applying of pressure upon the tuberosity of the ischium. Of course, in getting traction you have to have traction on your feet and countertraction at the head, and the countertraction is obtained by the pressure of the ring of the splint on the tuberosity of the ischium. One of the greatest faults is that you allow the ring to slip up over the tuberosity. Then, of course, you lose all your traction. Be sure that you feel your tuberosity and apply the ring to that; then apply the traction and it won't slip.

The second point is the traction anklet. One thing that the men have a great tendency to do, and I don't see why they should, is to remove the shoe. I should think it would be the last thing you would want to do. It takes time, it hurts the man, and there is no excuse for it. The canvas anklet which was developed and carried on every splint was made to fit over the field shoe, and if you don't leave the shoe on you have to use the foot. That is one of the common mistakes made in the application of this splint. They would take off the shoe and wouldn't put in any cotton; the anklet didn't fit, and it caused undue pressure on the foot and shut off the circulation.

The third point is the method of supporting the limb. The simplest and quickest way to apply the Thomas splint under field conditions is with three triangular bandages. Take them and fold them as you would fold a cravette, about 4 inches wide, and apply one of them

behind the middle of the thigh. It passes through under the thigh and over the two side bars, and then down around the back of the leg again, then it crosses and ties in front. That makes support from behind and support in front. Apply one in the same manner at the middle of the thigh, middle of the leg, and at the knee. That's all the support you need; you already have on your little dressings, and you put a circular bandage around splint and leg. Of course, it is necessary to support the leg on the litter bar.

Now for wounds of the lower part of the leg, below the knee, the Cabot posterior wire has been used and we have been able to get them most of the time, and that makes an excellent dressing for anything below the knee. They are kept in readiness at your station. The only points that need to be emphasized are the pressure pad behind the ankle and behind the knee. You see a man coming in with a Cabot posterior wire without pressure pads and he either complains of pain in the knee or pain in the heel. One is due to application with the knee too straight; the other is due to pressure directly on the heel. So be sure to put a pad just above the heel and on the knee.

They have developed three different appliances for applying traction to the foot. One was a shoe hook made with a string and applied directly to the side of the shoe. You cut a bandage in two and twisted it up. That was pretty good. Then they tried all kinds of things, but nothing has been developed to equal the original canvas ankle applied directly over the shoe.

It might be interesting to detail the movement of a compound comminuted fracture of the femur from the front line back through the divisional area. First, he is picked up by the first-aid men, who are with their companies, or by some of his comrades, and there you see all kinds of primitive applications of splints—the rifle barrel on the outside of the leg, a bayonet on the inside makes an excellent splint of the femur. They come in with a rifle barrel running under the belt without a first-aid bandage on, or they will apply it over the rifle barrel. Then inside they will stick the bayonet. That makes a very good dressing and with that dressing they come into the battalion dressing station, and that is where the medical officer first sees them. If the medical officer is not working under too heavy artillery and machine-gun fire, the Thomas splint is applied, usually not by the officer but by well-trained enlisted men. Let me say here that the efficient medical officer in the front line depends on them entirely—on the enlisted personnel. He can not possibly dress every case; he can't do any more than see them. If he is on his job he will train the enlisted personnel during the rest periods and then they can apply them as well as he can. Morphine is given if needed, and immediately he is transported to the ambulance dressing station. There the splint is inspected and necessary changes made. At the triage he is seen by the orthopedist and inspected and corrected after his ambulance ride. Thus you see the wounded man gets careful attention at every station. At the battalion station this attention depends greatly upon the protection from enemy fire and the number of cases passing through, and in many cases it is very meager. At Chateau-Thierry, in July, my battalion evacuated 600 cases from the zero hour (15 o'clock) to midnight, working in a ravine within 1 km. of the actual fighting, and you can easily see how much time was spent on an individual case, for two reasons—first, it was impossible, and, second, not wise because the most important thing was to get the patient out to a safer place before extensive treatment was attempted. Many interesting cases were seen during the drive, and one of the most interesting from a medical point of view was on the 22d, when a detonator from a "77" embedded itself in the bony part of the elbow of a man and remained there. I simply applied a wire splint, bending it to the angle the arm was, and sent him back. As you know, a detonator is the head part of a shell which contains the mechanism which causes the explosion. This usually flies off more or less intact and this man got it. One reason why I didn't remove it was because I was afraid it might be followed by hemorrhage. Besides I was busy and some one else could do it better. Ambulance stations are always larger and more protected and adapted for better work, and it should carry on the work done in the battalion station and improve upon it. Shock should also be treated at this station.

During the last offensive we were located north of Verdun and I saw all the fractures. We were located out of range of the smaller guns, in an old barrack. We also treated shock cases in a specially prepared shock room, and it was great to see the cases come in there in as

good condition as they did and it was greater to see them go out. Occasionally a man would come in with a poorly applied splint. We took it down and properly applied it and sent him on, and he was perfectly comfortable and went out feeling fine.

The work of the division orthopedist may be divided into work at rest and in the trenches. At rest, the divisional orthopedist has a pretty easy job, a sort of consultant to the division surgeon and to the men in the division. We have to see all the orthopedic cases that go through the divisional hospitals, consulting with the men on duty at the field hospitals. We have to advise the division surgeon from time to time of things which are going wrong within the division. In the early days before we went into the trenches the first time, the flat-foot question was a big proposition for the orthopedist during last winter. The cavalry, you know, were changed into machine gunners and the men in the cavalry didn't like that because they didn't want to walk, and we had a lot of trouble with them. So a large part of the early orthopedic work here in France was with flat feet cases, and they developed training battalions for them. When they were on duty they were not carried as sick; they were carried as on detached service, and in this battalion there was a line officer and one medical and orthopedic officer. There they could give them special training. Some were sent home and some were transferred, and the others went back to their organizations cured, and it worked out very well. At Neufchateau last winter, before we went into the trenches, we ran a camp hospital and really did a limited amount of surgical work and a lot of orthopedic work; and as the orthopedic work decreased, the surgeon at this training battalion was the orthopedic consultant of the division. We did almost everything and got away with it. In those days there were only few Americans here and we did a lot of things. The training of medical officers and enlisted personnel is another thing. When the new replacements came in we made sure they were educated in splinting. Men who are perfectly able to do good splinting in civil life may not know anything about it under war conditions, but they soon learn and do very good work. Another way is to check it up. A man comes into a triage and he has all poorly applied splint. It was my custom to see them apply the splint, and if two or three cases came in not properly splinted I took it up and found out the cause. It was surprising to see how quickly they corrected the conditions. It was a good thing for the men, for the patient coming through, and a good thing for the service.

During the time of a drive the division orthopedist stays with the other divisional consultants at the triage. That is the sifting station. He supervised the splinted cases and checked them. You are on duty 24 hours out of 24, and frequently it runs up to 6 or 7 days with little sleep. There every case is gone over, the splints are carefully looked over and reapplied if necessary. You frequently find there cases where the splints have been applied for some time and where for some reason circulation has been cut off, either from tight dressing or some other cause, and these cases you have to take down and reapply the dressing.

As to the equipment of the battalion aid station: The medical supply officer and the divisional orthopedic surgeon formulated from time to time circular letters setting forth the equipment that should be carried by each individual unit of the Medical Department. This was so that every one carried just the right amount of equipment, as far as I was concerned, for splinting.

The most difficult thing that we have had to contend with is the condition of trench foot, which was just developing in our division in the last days of hostilities. Wet and cold are predisposing to the development of trench foot. There developed 35 or 40 cases, which are altogether too many. They wore the shoes too long without removing them; they had been in shell holes for several days where they couldn't move from morning to night, and of course their food was poor, and they also went in some cases from 15 to 20 days without removing their shoes.

Army Sanitary School No. 169.

THE MEDICAL SUPPLY OFFICER OF A DIVISION

By Major Walker, M. C., United States Army, November 27, 1918

Our medical supply depot of the 26th Division, during engagement and during rest periods, had its location, as a rule, in the same town as the sanitary train. We have followed in our division the Tables of Organization in that the medical supply unit is attached as a part of the sanitary train. Most of the divisions I have found have carried the medical supply unit with the headquarters of the division surgeon. Our depot was situated with the sanitary train, as a rule about 8 or 10 km. back of the front line. Our unit was lucky in obtaining in nearly every move adequate quarters for supplies and for the personnel. We were very lucky as a rule in getting out ahead of the other fellows and finding a roof where we could shelter our supplies, although some towns were very destitute of good buildings, and at times it was rather difficult. We carried, in addition to the medical and surgical material, the divisional dental supplies. Our personnel at first was rather large—21 men—due to the fact that the medical supply replacement depot of the 26th Division was the second medical supply unit in France, the first being the base at Cosne, and the second the 26th Division. Thus we had our supplies from the seaport in earload lots, and furnished supplies to the other divisions. I think we furnished the entire supplies for the 2d Division and part of the 1st, and I have helped equip several supply depots since. This was during the latter part of the year 1917, when we were stationed at Neufchateau. The depot at this time was too large for the position and immobile. A medical supply unit should be mobile and easy to handle. Our personnel was reduced to 13 men, exclusive of officers. The personnel consisted of 2 officers—myself and a lieutenant of the Dental Corps—a sergeant, first class, a sergeant, 2 wagoners, a dental assistant, and 8 privates, first class. Our material and transportation consisted of about 7 earloads, or 15 trucks, and that was an unwieldy amount of material, too much involved, too large, that we have reduced it until at the present time we can transport it on two of the 3-ton English trucks. These trucks have done us service since we have been in France and are still running; they have probably covered more miles than any truck in the 26th Division; and, in addition, we have a light Ford delivery car. The lieutenant of the Dental Corps, with his assistant, has charge of the filling of requisitions for material required by the dentists attached to the divisional units and the divisional field laboratory; all supplies for the same being requisitioned for by the medical supply unit, accountability and responsibility being carried by the commanding officer of the medical supply unit.

The first requisite on moving into a sector and establishing is to get a line on your sources of supply. In the early days of our participation in this war the base medical supply was so far away, and the delay in getting requisitions properly indorsed and the French railroad system so slow, which you probably know, great inconveniences were experienced; but as time progressed this difficulty was obviated by the establishment of army medical parks, or dumps, as they were first called, but later changed to parks, 15 to 30 km. in the rear of the front line. After leaving the Chateau-Thierry sector I was able to go direct with my outfit to the army park at Vaubrecourt and get what I needed and consumed only half a day's time in the transaction, whereas before, dealing with the slow railroads and delay in transportation, there is no telling when we would have got it. This cut off the necessity of carrying a large stock on hand. The supplies were supplied on requisitions signed by the supply officer of the receiving unit, simplifying the transaction a great deal. The medical supplies of the supply unit need to be considerable in amount and the supply at times considerably varying, depending upon the number of attached troops. We have had at times as high as 45,000 men to cover. When we were in the Toul sector we had engineers and other outfits, aviators attached, in addition to our men which we covered to make 45,000 troops. So if your base of supply is far away you have to be foresighted to see that you have a fair amount of stock on hand. The essentials of a depot, as in all other cases, are a good sergeant, a good man with the typewriter to keep your paper work cleaned up all the time. Although accountability was supposed to cease in the advance zone of operations, we made it a practice to keep our accounts

just the same, thereby avoiding possible trouble later in life. It is a great deal better to keep it up in the old way than not to keep any accountability and then perhaps two or three years after you get home put in 10 years trying to settle it, and you will have to work quite a while to get enough money to pay for this material; and although accountability was supposed to cease after we left the Services of Supply, yet I maintained it all the time. I can not enumerate all the articles carried at our depot, or the amount of each article, for they vary with the casualties, be they great or small.

I must pay a tribute to the American Red Cross for the assistance rendered me in the way of supplies in the Chateau-Thierry sector. The Red Cross people carried a good stock of dressings, blankets, and 1, 2, and 3 front-line packets, so that every night I went to the storehouse and looked over their stock and was able to cover myself if anything came up in the night and I ran short.

The first important duty is to have the medical personnel of the entire division properly equipped. The work of supply in the sanitary train is taken care of by the supply officer there, he having under him two lieutenants, one for field hospital section and one for the ambulance section; they collecting requisitions from their four organizations and consolidate and turning into him for consolidation, and he getting the material from the medical supply depot and delivering it through his assistants to the organizations under him, thereby doing away with officers from four field hospitals and four ambulance companies or sergeants or messengers running to the medical supply all the time. "You find they like to run down there; it kills time and they like to talk, and it bothers you a great deal. You can simplify matters by keeping everybody out and thereby saving time and patience of too many members to the transaction. The divisional sanitary units, exclusive of the sanitary train, send their requisitions through the ambulance companies and they deliver direct to the line. Nobody in the division was allowed to do business with the Red Cross except through the commanding officer of the medical supply depot. We had little difficulty in getting supplies and practically no complaint from front-line units. All organizations were supposed to be fully equipped before going into combat. Supplies needed during engagement are blankets, litters, dressings, 1, 2, and 3 front-line packages, antitetanic serum, a good stock of 10 c. c. syringes, morphine in ampoules. This is to be used only in front-line work and in ambulance dressing stations. If you have one of the field hospitals operating as a severely wounded hospital, another as a gas hospital, a third as a triage or sifting station, and the fourth as a hospital for slight sick, oxygen, gas equipment, and a line of drugs is necessary. The amount can only be determined by experience and the number of casualties in an action. Sector troops on the offensive need large quantities; troops on the defensive need large quantities, particularly when under constant shell fire. Instruments, ligatures, ether, sterile dressings, adhesive plaster, aspirin, etc., all have their place, but drugs are only a small part and are of secondary importance. A carefully prepared list of splints carried by the ambulance companies and field hospitals and a minimum carried as reserve by the medical supply was proposed by the division orthopedist. Each sanitary detachment in a division had a certain number of different splints which are carried with their combat equipment, and this list was made up by the division orthopedist and approved by Colonel Porter, the division surgeon. The splints carried were the Thomas full-ring leg, Thomas half-ring leg, Cabot posterior wire, the Thomas hinged arm splint, Liston splint, Jones splint, ladder splint and litter bars, foot pieces, triangular bandages, muslin bandages, cotton rolls, adhesive rolls 1 inch and 2 inches wide, straps and buckles, dressings, medium and large paper clips, etc., and every organization had all these. So we were very fortunate. I used to take a little time going around to the supply depots and seeing what they had on hand and find out when a car of supplies was coming in, and if I needed anything I put in a requisition for it and got the supplies as soon as it got in. The things supplied by the Red Cross to the men in the front line were a world of comfort to them, and we should not fail to mention the cigarette not supplied by the M. S. U. The great difficulty is in maintaining a stock of blankets, litters, and splints—three essentials in the evacuation of wounded—and unless you have a good noncommissioned officer on the job at the triage to see that the ambulances bring back from the evacuation hospitals the replacements for litters, blankets, and splints as they go down, you are going to lose your whole stock. He may have to keep right on the job all the time during activities;

otherwise you lose your stock. There are other divisions in the front as well as yourself, and they are entitled to just as much supply and everybody should be fair and square about the supply game, and if you lose out on that you can not get certain splints, because there were times when it was absolutely impossible. We went weeks without a Cabot posterior splint and couldn't find one anywhere, but later, as the supply parks got nearer to us, they were fully equipped with splints, so in the St. Mihiel and in the Verdun sectors we had plenty of splints of all kinds. But if you have some one at the triage looking out for the ambulances bringing back just what they take down on the patients you will keep your stock up, and that's what you have to do. Blankets, litters, and splints are the three things you have to have outside of dressings. Dressings you won't be bothered with, because you can get them from the Red Cross and they have plenty of dressings; but the other three essentials are things that you have to have, and unless you are extremely careful you are going to find your stock gone and then you are high and dry. If the supply officer is alive he will keep after everybody concerned, and when his division goes into repose he will have the satisfaction of knowing that his stock is complete. You must see that the sanitary units do not overstock. There is always a habit in men to get all they can and when repose comes equipment A is all that is to be carried, and the extra supplies will be turned back to you for salvage. So I got to know the medical officers of the division and how far to check over their supplies. As the division advanced in combat it was very necessary to establish an advance depot in close relation to the triage. This depot carried only the necessities for active work enumerated before as essential. All supplies were issued to organizations on memorandum receipt. Some clothing was carried for gas cases, and also material for lights to do night work in the ambulance dressing stations, etc., such as carbide, candles, Prest-o-Lite tanks, etc. Replenishments were made from the main depot.

On the Chateau-Thierry front it became necessary to establish a second advance depot. A one-half truck load established an advance station. It was quickly loaded. Experience told me what was necessary. Dressings, 1, 2, and 3 bandages, candles, etc., sufficient in amount for four to six patients, put up in sandbags and sent up by the ambulances on their return trip to the ambulance head, and these bags of supplies were turned over to the litter bearers who took them to the collecting head. It was extremely difficult with rapidly advancing troops to keep them supplied, but they always had plenty. Our medical supply unit was nearer the front line just before the St. Mihiel drive than any depot before—about 5 miles. When we go into rest the units are reequipped all ready for resumption of activities. The number of litters carried by the division is 1,380. In addition to that, just before we went into action it was increased from 300 to 600 American litters if I could get them. The blankets I used to carry at the field hospitals, at the ambulance companies. They are supposed to have their designated number of blankets, and I used to have requisitions in, as a rule, for about 2,000 blankets and I drew these and handed them out. During an engagement I would probably draw four to five thousand blankets. I know of one division in 10 days in action used 15,000 blankets and 5,000 litters, but they evidently had not had replacement of blankets and litters. At one time I drew 1,710 blankets, and when we cleaned up I had 1,893; so I was long on blankets. Therefore, when we went into the next area I had my stock on hand and didn't have to bother for any supply. Of course, where you carry that amount of stock you have to have a lot of transportation, and if you had to move, you sometimes had to make two trips, unless we went some distance and moved by train. You can carry on two trucks all that is necessary, and what's over you can salvage before you make the next move. We started out with 15 trucks or 7 car loads and we are now carrying two trucks and carry our complete equipment. We salvage practically all blankets, every splint, all the dressings because they are of no use now that the combat is over.

As far as I can ascertain I am the only medical man who is the commanding officer of a medical supply unit; in the other divisions they are Sanitary Corps men; and I maintain, and justly I think, that the medical supply officer of a medical supply unit should be a medical officer. Although you may have your supply officer a Sanitary Corps man, who has been a medical sergeant for a number of years and knows all about supplies, but there is something about it that I believe a medical officer can do better work and keep up the supplies and look out for the future needs of his division.

Army Sanitary School No. 171.

PROBLEMS OF THE REGIMENTAL SURGEON—THE DENTAL SURGEON AS AN AUXILIARY
MEDICAL OFFICER

By Col. Philip W. Huntington, M. C., United States Army, December 7, 1918

When I came down here, gentlemen, I hadn't expected to have the pleasure of addressing the dental class, and I am mighty glad to talk to you. I haven't prepared any notes for a lecture to the dental class and what I have to say is mostly in regard to the medical work of the division in combat, but I think it will have considerable value in connection with the Dental Corps because—at least in my division—the dental officers during combat performed exactly the same duties as the medical officers. In the 79th Division the dental officers during combat serve as auxiliary medical officers. They were attached to the battalions and they went forward with the battalions and functioned in the battalion aid posts, regimental aid posts—or wherever their services might be needed—and performed exactly the same duties as medical officers, and I might say, as I told Colonel Boak, they performed very satisfactorily, very creditably, very well. I have been division surgeon ever since the Seventy-ninth was organized and am still, and the work of the dental surgeons has not been confined to dental work entirely. They were used in a military medical sense; I had that idea from the very beginning; I felt that if they were going to be called upon to do the duty of auxiliary medical officers they were entitled to training, and I proceeded to give them training ever since the division was organized. I commenced training the dental surgeons along the same lines for field work as the medical officers. They were given all the training possible without forgetting their specific professional duties.

I thought it might be of interest to you to tell you of one fight my division was in. On the 15th of September we were moved up into line just on the edge of the Argonne Forest. We took part in the big drive up there commencing on the 26th of September. We were in the Fifth Corps. There were three corps in there, from the west bank of the Meuse to the Argonne Forest, and our division was the middle division of the middle corps. Although it was our first time in the line, and some of our men had not had a shot fired over them, we were fortunate to be assigned to a central location in the attack and to take as our objective the strongest and most fortified town in the whole line, the town of Montfaucon, which was afterwards taken by our division, and I think it may be of some little interest to you to tell you something about this engagement and in that way possibly I can make it a little plainer and a little clearer and show you just exactly what the situation is with a division in the field in combat, in open warfare. I have drawn a little sketch here to show you as well as I can some of the salient features of that particular fight.

The First Army at that time had 9 divisions—3 corps of 3 divisions each, and the army was occupying a front of about 20 km., so you can see that each division had a front of only about 2 km. or a little over on an average on the jump off. Our division, like so many American divisions, became separated from its artillery brigade. It came over here but has never joined us. But this time we were furnished French artillery, and such a concentration of artillery I have never dreamed possible. It was stupendous. I never saw anything like it. It was one of the most impressive things I have ever seen, to go up there through those woods in back of our line and see the artillery in there. This was a woods in here [indicating]; it was just jammed full of French artillery. I never saw anything like it in my life. We had behind us about 300 guns and most of these were long 155's—6-inch rifles. It was extremely interesting to go through there and see them—to see the French, their way of living, etc. These 6-inch guns were manned by bluejackets, officered by French Navy officers. Well, this was the situation with our division. This little town here is the town of Avocourt. This is the town of Haucourt, and this red line I have drawn here indicates approximately the position of our first line at the time of beginning of operations, on September 26. Before that time we were back down over here and our division post of command was at a little place called Caesar, which I have indicated here by this red mark. On Monday the 25th and the morning of the 26th, the artillery barrage began at 11 o'clock on the evening of the 25th and continued right up all night long. We were living here and the artillery was all

around us. There were 12 or 15 of these 6-inch rifles within 100 yards of us and they nearly lifted us out of our dugouts. They were laying down a barrage across the German lines here and they were also punishing this town of Malancourt and Montfaucon, while on the morning of the 26th, when the troops made a get-away, they got across here and met very stiff resistance, mostly—as the Germans have been doing all along there—from machine guns, and we had some very heavy losses going through this No Man's Land and going up through the edge of these woods in here. You notice these woods give a fire almost directly against our front line, and when our troops got up here [indicating] they got enfilading fire from this place. It was a very hard proposition indeed. Well, we went along and by the evening of the first day we had gotten up about where I draw this line here [drawing line], in the northern end of the Bois de Malancourt. Of course, I had to make other sanitary dispositions, different from those we had needed in trench sectors. I had my sanitary units all placed, but as we advanced I had to make other dispositions, which I did, and the farthest fixed unit was an ambulance dressing station just north of Montfaucon, just side of this road. The wounded were coming in in very large numbers and there was a great deal to do. This road from Malancourt to this junction was used not only by our division but also by the division on our right, the 4th Division. The traffic was very, very heavy and made the roads almost impassable. The next day we went along and took Montfaucon. We had again very heavy losses, particularly from machine-gun fire. This town (Montfaucon) the Germans called the Gibraltar of the Argonne. It was extremely heavily fortified. It is a perfectly round hill; slopes up like this [illustrating], and was originally was quite a large town. It has been under artillery fire for a long time, however, and is knocked to pieces. It was full of reinforced concrete machine-gun posts, observation posts, and all kinds of strong places. Incidentally, there is an observation post in the ruins of a church, a very remarkable one which is said to have been occupied by the German crown prince during the Germans' attempt to take Verdun. It has a wonderful view; you can see the country for miles and miles. I have been in it a number of times. Well, as I said, we suffered very heavy losses here. The Germans had just plastered that town with machine guns and all around it; and, incidentally, gentlemen, as I was saying to Colonel Boak last night, you may have read in the papers about the morale of the German Army being destroyed and being down in spirits because they were licked. It may be so—I don't know; but those we had up there had all the morale that was necessary for them to fight and stick, and they did stick, and don't let anybody tell you anything else. You have to hand it to them; they are the greatest machine gunners in the world. When a crew will stick with a machine gun and let two or three waves of Infantry go over them before they turn loose, they are "there" and they will stick and fight it out.

Well, we kept on going and got past this town. We were in the line altogether six days. Now after we got up about here the traffic over these roads bringing up material, bringing up ammunition, bringing up food, etc., became so heavy that the roads just simply couldn't stand it. This road from Avocourt to Malancourt—you hear of roads being a series of shell holes; this was a ditch, it was all shell holes, many of them overlapping each other. Our division engineer estimated that it would take 8,000 tons of rock to rebuild that road. But they had to run over it, and then ran over it anyhow, as it was. The traffic came up this way from Montzeville to Esnes, to Haucourt, to Malancourt, and going back it went down here to Avocourt, and so on. That is, theoretically it did that; practically it flunked. We had one traffic jam that stands out particularly in my mind because it lasted 48 hours. Absolutely. For 48 hours solid there wasn't a wheel turned either way. Now if you can imagine any more hopeless and helpless feeling than to be a division surgeon and have two or three thousand wounded on hand and have sent your ambulances full of wounded 24 hours ago and not see any of them come back, and have a complete road block on your hand—I don't know what it is. That's the proposition we were up against. Now this is getting pretty far away from dental surgery, but it has a bearing just the same. Now that road block was due to two things: One of them was that we didn't have enough engineer troops to build and repair these roads quickly enough; the other was that we didn't have an efficient and properly instructed military police force. I don't know whether any of you gentlemen have had very much in the way of experience with military police matters, but unless we can improve on our system of military police, traffic control, before another war, I am in favor with doing away with

them altogether and putting some of these wooden Indians on the job. We have got to have something done in order to control this traffic, and it isn't just enough to just post these men at crossroads. My idea is that we should have men making constant trips up and down the roads so when a traffic jam starts there will be somebody to handle it. Here is the way it starts: A truck tries to go around a wagon ahead of it and another truck is coming the other way and they meet. Neither will back up, and they commence to swear at each other. Other trucks come up and there is a traffic jam. Now, if there is somebody there nine-tenths of these traffic jams can be eliminated; and I speak feelingly of it because these traffic jams were responsible for the loss of hundreds of lives. Absolutely.

Well, as I say, we were getting lots and lots of wounded and we had a large number of them in this wood right here, just east of Montfaucon, and as I told you a minute ago, all my ambulances had gone back to my field hospitals down here. It took them 60 hours to get back. They don't tell you about that in the book, but that's what happens, and I didn't have a thing, not an ambulance—not one motor ambulance, but, luckily, Heaven be praised, luckily I did have some hard-tailed mules. I have been a strong advocate of the animal-drawn transportation in the Medical Department ever since I have been in it. I knew I was right then, and I know I am right now, and anybody that tries to talk me out of it has got to throw me down. They will and can go where motor ambulances can't. Some people say it isn't so, but I know it is so—I have done it. These little Ford ambulances work under certain circumstances and will go over rough ground, but there are places where a Ford can't go. Well, I had these mules. This road jam showed no signs of opening up. I had to do something. I couldn't send them back to the field hospital and what I had to do was to bring the hospital up to them, and I did. I sent back to my advance medical supply depot—by the way I had my medical supply officer move all of his divisional medical supplies up to this place here—and I sent back word to get two field hospitals equipped and loaded in these animal-drawn ambulances and brought it up to the crossroads—over barbed wire and through shell holes; while this road block was on we came across No Man's Land here—and that was a hell of a place, too—and we came on up to here. By that time our division post of command had moved up to this junction of the road to Montfaucon and Cuisy—Cuisy Junction. I brought this field hospital to this place, the southern edge of a wood, and I put them in tents. Luckily I had a hunch before this thing started, and I got a lot of paint from the Red Cross and drew on the top of the ward tents big red crosses. I got these tents pitched and I put the wounded under them. We had about 600 wounded, and I got started in the evening. Just about 15 minutes later a hard, cold rain started in. I don't know anything that made me feel more relieved than to know that these poor wounded men were under shelter, out of the rain, and getting attention. We were evacuating down to Malancourt and from there we carried them on litters to Avocourt, about 6 km. That's the way we got them out. Well we had been running these two field hospitals here—by the way, the road went along like this [indicating] and I had my hospitals pitched about like that [indicating]; this representing the white tents, and back of them I had some small conical tents and some wall tents that I was using for dressing, operating, etc. These tents [indicating], as I say, had big red crosses. Well the next day—I got it working about 4 o'clock in the afternoon—the next day at about 2 o'clock a boche airplane came over and—incidentally, I don't know whether you gentlemen have read in the papers about the supremacy of the air. You have probably read about that; and while this is another thing that I don't question—it may be so, but I have never seen it—the allied supremacy of the air doesn't happen whenever I am around. It may be along other parts of the front, but I haven't seen it. Well, anyhow, this boche aviator came over about 2 o'clock and he wasn't 100 m. in the air; you could see him very plainly—I could see him looking over the side. Well he flew around there for about 15 minutes. There wasn't a combatant unit closer to us than a kilometer; there was a machine-gun battalion in here; that was the closest thing. About 20 minutes after this boche aviator flew away the shells commenced to come in over here. Now, those people can shoot; they hit where they shoot. They weren't shooting at these little tents; they were shooting at the ward tents and they hit them every time. They threw 35 high-explosive shells into that hospital in about 15 minutes and they made direct hits. They didn't hit these [indicating]; they weren't shooting at them. Well, I don't know whether any of you

have been in that situation. It is bad business. We had about 600 patients in there and I imagine, roughly, about half of them were walking cases. We told them to go and they did. They came across lots here. They hiked right out; they didn't wait to be told again. But we had about 300 patients who couldn't walk—severely wounded, fracture cases, etc. Of the patients in the hospital the boches killed 16 and they killed part of my personnel. And if you can imagine a more complete pocket edition of hell than what we had there—I can't, that's all. It was the worst thing I ever saw in my life. Well, it is a perfectly remarkable thing to see how a stunt like that brings out what's actually in a man; what's really and truly in him. It was most remarkable. There was one of my sergeants—I was right close to the place at the time the thing commenced. I was right here at the division post of command when they commenced shelling and I came out and saw what was taking place and got there just before it was over. This sergeant said "Colonel, I am yellow as hell; I am scared to death; give me something to do." And I did. I told him what to do. He was one of the bravest men I ever saw, as a matter of fact. There was a little French interpreter—I don't know where he came from, an officer of the French service—he came galloping down this road and jumped in and carried patients on a litter all afternoon. He was all polished up, shaved, clothes brushed, shoes shined—prettiest thing you ever saw—but he was right on the job and he worked. There was a little second lieutenant of engineers. I don't know where he came from; the first thing I saw of him he was working. These machine-gun fellows, as soon as the shells commenced falling, ran right across and commenced carrying. I sent up here and got trucks, water wagons, and the machine-gun battalion took them on litters down to here and so on, down to here. Well by that time it was dark, raining of course, and everybody was more or less scattered, but I had given orders to have these patients taken down to the old dressing station just north of Malancourt, and we did. We got them down in horse-drawn transportation that could squeeze down along the side of the road.

More troubles. There was a field in here and a battery of American rifles in here firing, and we no sooner got our patients down here than the Germans commenced throwing gas; they just completely filled that place with gas. Well, we were tired, but we couldn't leave these poor devils there—that's all there was to it. We picked them up and carried them down by hand, way down here [indicating] and established a field hospital there. Well about that time this road jam commenced to break up and my ambulances came back to the station and we were able to function. I established an aid station here [indicating] and another here on the road to Montfaucon, and the thing ran along a little better. This is a rather rambling narrative of the way the thing goes, but I wanted to tell you, to impress upon you the fact that these things don't go by diagrams. You can draw all of them you want to and it is the plan to work if it will work, but it don't always work, and when it don't you have to do something else. That's the point. It is up to you. And in my division, not once or twice, but lots of times, you gentlemen of the Dental Corps have been up against that proposition. It has happened time and time again that the only medical officer with a battalion was the dental officer and he would be entirely responsible for the organization. One of our regiments went in with a full quota of officers and came out with 2; one regiment lost 4 majors in two days. When you get in a thing like that you can not sit down and wait for somebody to come and tell you. You can't fall back on theory or what you have learned from books or diagrams. You have to say what's to be done and do it. Don't wait for somebody to come around; it's up to you individually and personally.

Now, there are several little points here that I want to bring out in regard to combat. This is very rambling, indeed, but some of these things are of interest, and from my point of view they are of importance. Now, you will hear a lot about gas. Well, of course, in this open war—and everything I am saying pertains to open warfare; please get that straight, I am not talking about trench warfare at all. In open warfare the conditions for the use of toxic gas are not as favorable as in trench warfare. You won't have projector attacks. Now among green troops particularly you will have a very large number of gas casualties that haven't had anything to do with gas. Very large. The men get tired, and I mean really tired—they are exhausted—and then a high-explosive shell bursts near them. They get a smell of the acid, which is very irritating, and they think they are gassed. They go to the medical officer. They are worn out. He thinks they are gassed, but they are not.

What they need is 24 hours' sleep, a meal, hot food, and they are all right. But you want to watch out for these people and don't send them back with an improper diagnosis. If you think they are exhausted, put down "exhausted." It is perfectly proper to evacuate a man for exhaustion; but, on the other hand, don't overlook the gas casualties if you can help it. It is very easy to overlook phosgene and mustard gas when they are new; it isn't after a couple of hours. Incidentally, if you are in a battalion aid post and the boche commences to put mustard gas in there, there is just one sensible thing to do and that is to go somewhere else. Move your patients out and go away. You don't want to stay around mustard gas. The only preventive against mustard gas is to go somewhere else. Now; you have probably heard about battalion aid posts and you may have to run one. I hope you won't, but you may. Our battalion aid posts were nothing except places. We had no shelter; no dugout. They were as flat as this floor and as open as this room. It was a place as favorable as you could find, a place to sort out patients—that's a battalion aid station, out in the open. So don't think you are going to have shelter and concrete dugouts and things like that, because you won't. I don't know whether you have or not, but I guess you have heard a lot about liaison in the field. They will talk to you about the necessity of maintaining liaison, which means nothing more nor less than communication. It's a necessity, it's a valuable thing, and ideal to be striven for; but it is exceedingly difficult to maintain liaison in the field in battle. On the other hand, if your division surgeon tells you that he wants you to keep him informed of where you are at all times, please don't think that the division surgeon is doing that to satisfy his own personal curiosity, because I assure you he isn't. It is merely that he may keep you supplied with material to do your work. Absolutely. It is perfectly astounding how hard it is to realize that if the division surgeon don't know where you are he can't send the stuff to work with. They used to come kicking, "I haven't this; I haven't that." I said, "Where are you; where's your station. If you let me know where it is I will send you supplies." Don't forget, if you are a battalion surgeon, to keep your regimental surgeon informed where you are. Then map reading. Learn to read a map and coordinate, so you can send a report to your regimental surgeon and tell him "Battalion aid post, 3d Battalion, is located at 26.7, 35-5," and he can find you. If you do that half of your problems will be solved because they know where you are. The division surgeon is more than anxious to keep the officers supplied with material and men to do the work properly, and if you let him know what you want he will get it for you if it can be done under heaven. Now responsibility for that rests with the front-line units. The division surgeon has only a small office, he has no runners; he can not send a runner to the battalion; it is up to the battalion surgeon to send runners to the regimental surgeon, and from him to the division surgeon. Now one of my regimental surgeons didn't let me know because the telephone wasn't working. If the telephone isn't working send a runner; if you haven't one send a lieutenant, and if you haven't a lieutenant come yourself. If the situation is such that you haven't any runners and there is no one to send, come yourself personally. You must let them know; if you don't you won't be able to do the work.

Now, another thing is the question of supplies. When you get in a moving engagement such as this one, you have such a chest to carry things in. That's very nice, but you haven't transportation for it. What you have to do is to take the stuff with you. Now you gentlemen in the dental service, you are going to be up there doing first-aid work, and you won't get much in the way of dental equipment to carry. You carry your emergency equipment in a little haversack. You need it. If you have a medical cart to put it on, put it on there. If not, you have to pack it on your back. The same way with the medical supplies. Some of my medical officers walked off and left the litters lying on the ground. They didn't have the medical carts. They had 48 men to take them up. If you can't do anything else, you can try what we did, and I think it a practical and good scheme. We went to the division engineer officer and got two bales of gunny sacks and I gave them around to the regiments, and when they went up they put some Thomas splints, bandages, A. T. S., iodine tubes, and things like that in them and carried them up. That was my ambulance dressing station. They carried the things in their hands, and they moved faster and did more work, and better work, than the outfit that tried to carry their whole equipment on transportation. So when you can, carry what is necessary. If you don't know what is necessary, ask the regimental surgeon. If he don't know, ask the division surgeon. Take what is necessary and don't let it get away from you.

Now that brings up the question—what was the burning question in movable warfare and that is A. T. S. and glass syringes, which are easily broken. Of course, you can give the A. T. S. with a hypodermic syringe, because we did it. But in my judgment A. T. S. should not be given by the regimental personnel at all. I don't think they even ought to try it, because when they get in a rush they don't do it; they can not do it, they haven't time; and half or more patients get back to the field hospitals without A. T. S. and you can give it to them there. Now why not give it all at one place, where you give half of it anyhow?

Colonel BOAK. Suppose you can not evacuate your patients for 36 hours?

Colonel HUNTINGTON.—Well, that's a good point, of course. There will be times when that happens. You will have a number of other dangers, too, which it is not pleasing to contemplate; but I believe in the thing, I believe it would be just as practicable as anything else. As a matter of fact, they don't do it, the glass syringes break, the A. T. S. gets busted in the ampules, and they have a deuce of a time trying to give it. It just falls down where you have a lot of casualties

Now that brings me to another thing, and that is the question of shock. Now, gentlemen, if you have a tent, if you have three litters and some blankets, and some solidified alcohol, which you should have in your gunny sack, you can treat these shocked patients. You probably have seen and have had explained the deshoeking apparatus. You can make a deshoeking bed out of three litters. Stand two litters up on edge and put another across, and put a can of solidified alcohol underneath and light it, with blankets over the patient. It works just as well as elaborate and expensive things. Now, I don't know how much experience you have had with surgical shock, but I want to tell you that from my point of view that is the most serious condition that we have in regard to wounded. If we can successfully treat our shock patients, including proper splinting, we will get away with our medical services pretty well. Lots of patients in our division died from shock—that's all there is to it. Personally, I didn't see but one death from acute hemorrhage, and he had his artery cut by a shell splinter, but I did see a good many people die from shock, and, believe me, shock kills them and don't think it doesn't. They died from it, over and over again, from comparatively trivial wounds. On the other hand, if you have proper antishock treatment you will save people whose lives you wouldn't believe it possible to be saved. It is perfectly astounding. When we had this field hospital up here I saw 50 patients in there for whose collective lives I wouldn't have given a nickel; I didn't think there was a possibility of their living; and five or six days later I saw 35 of them in splendid shape—lying in bed, smoking cigarettes, and just as happy as could be. I didn't think there was a possibility of one of these men living. Certainly three-fifths of them pulled out. What their ultimate fate was I don't know, but they got through the early stages, and just simply because they had proper deshoeking treatment. If they didn't they would have died. Now the contrast was impressed upon me very strongly at the time of this road block. I had patients all the way from here to here [indicating] in trucks and didn't have any ambulances, and they laid there for 48 hours in those trucks. I personally spent two nights walking this road from here down to Malancourt trying to look after these poor chaps. We brought up kitchens and gave them soup, coffee, cocoa, etc., and I took my director of ambulance companies and some men and we put in two nights there trying to fix them up. But I would hate to tell you how many we had to take out of those trucks and lay alongside the road. It was the most heartrending thing you could imagine. Every one, I think, died from surgical shock; every one of them. Don't forget it. We had one instance. One of my little Ford ambulances started from up there with three litter cases and when they got down here two of them were dead and the other died shortly after. And they died from shock. If you can get these people into a deshoeking cabinet, if you can get them hot food, preferably soup and bicarbonate of soda, and rest, and proper splinting, it is perfectly marvelous to see the way they come up; and, incidentally, they take soup or coffee much better than cocoa. I noticed a very considerable number of these shocked cases became nauseated after taking cocoa.

Now in another sector, in stable warfare, we were just north of St. Mihiel, at Troyon-sur-Meuse. There was a big ridge of hills there, and up here [indicating] is the valley of the Woivre, and our lines were on top of a hill, where you can look out over the whole world. The boche were down in the valley. It was the nicest thing to hold you ever saw, and that's all we were doing. I had an ambulance dressing station in a church at Dommartin, and by some strange

freak of fortune the boche had never hit that church. We had our dressing station in there, gas washing, two or three deshoeking tables, nice ones, and always three galvanized-iron tubs, filled with soup, coffee, and cocoa, and everybody that came in got some, whether they wanted it or not, and they likewise got a big, heaping tablespoonful of soda in the solution.

Now Goldthwait and Baer will tell you to train your enlisted men to put on splints. So you should, but that splinting has got to be supervised by an officer, and if you think that isn't so, you are wrong. If you don't you will have an inspector along asking why this man lost a leg from gangrene. That's a fact. But it's all right to teach your enlisted men to do it; they should know; but it is exactly like everything else. Take your paper work, if you sign your name to a report, you are responsible for it no matter if the sergeant did make a mistake; and if a man putting on a splint does it wrong you are responsible for it. Don't forget it. You have to check up every bit of that splinting and see that it is done right.

There is one thing that I do not want to impress upon you. We may some time get into this stable warfare again; we may get where we have battalion aid posts in dugouts or shelters, or something of that kind, and one of you may be put in charge of one of them. When you do, don't—please, gentlemen—don't sit down and wait for somebody to tell you what to do. But get busy and fix it up. Put in some deshoeking racks, build some racks out of scrap lumber to put your litters on, so that instead of having space for only one litter you will have space for four. Get your food situation fixed. Some one said something—I think it was Napoleon who said once, "There is only one military mistake which is unpardonable, and that is inaction." That's the only one. You may make mistakes; you may do wrong; but do something anyhow, because if you do nothing it is a hundred per cent bet you are wrong, but if you do something you have a 50 per cent shot at it. I can't tell you that with enough earnestness. I have had battalion surgeons of all kinds. Some of them would go in and sit down and think their responsibility was ended merely by the fact that they were there. And I have had other people who, as soon as they got there, would commence to use their head and see what they could do to improve their facilities so as to better help the patients when they were brought in. When you are in that situation try and figure what it is going to be for these people coming in and try to provide for them beforehand. I can not emphasize that too strongly.

Now, another matter that I think is a very important thing, and that is do not unnecessarily expose yourself or your personnel or your patients to enemy fire. There are lots and lots of times when you can not get shelter, but there are times when you can. But if you can not get material shelter in a dugout or something like that, try and get concealment. Very often a thick hedge is good protection against rifle fire as anything else because they won't see you, and it is your duty to protect the lives and limbs of yourself and your enlisted assistants and patients at every possible cost. Now right in that line there is another little point that I think is very important, and that is when you get out in this open warfare, when you walk across an open field, like this one here [indicating] and there are wounded lying all over, don't make the mistake one of my medical officers made. He started going around from one wounded man to another dressing them. By the time he got to the third one they commenced coming to him, and then he had seven or eight, and then had a hundred, and there he was—stuck; he couldn't move. Don't do that. When you have wounded to treat go and pick out a place. Don't look at them all. Pick out a place and stay there and have the wounded brought to you. If you start dressing them on the open field, before you finish with one you will have more, and you will have such a mess you can not do anything. This may sound trivial, but it isn't. Our experience has been that the Germans do not use artillery fire against one or two men, but they do against three or four or more. In all this sector you couldn't get out in groups of three or more without getting sniped at, and it was mighty uncomfortable.

Now it may happen that some of you may be on duty in a field hospital. In one division the dental surgeon was the triage officer. He received all patients, sorted them out, and said where they were to go. If any of you are responsible for that, use your utmost endeavors to see that the blankets and litters, hot-water bottles and splints that come in with these patients are replaced and sent back by the ambulance to the front. If you don't

the next day the poor devils are going to be out of luck, that's all there is to it; you have got to do it. The ambulance companies bring these people in there on litters. They are blanketed. They frequently put hot-water bottles on them, and they almost always have splints on them, and they came from somewhere and they came from the regimental surgeon, and he got gray hairs getting them; and if you don't send them back, if you don't replace them, the next day the wounded are going to be out of luck; they will be coming down without blankets, without splints, without hot-water bottles, and then there will be hell to pay.

Now, gentlemen, you can not do this business—all that I have been telling you about; you can not do it and get away with it successfully unless you have discipline. Discipline among your enlisted men. That's all there is to it. And let me tell you first of all the basic source of discipline is inside the officer himself. The officer himself must be conscious of his duty as an officer, conscious of the necessity of performing his duty to the best that is in him, and by setting the proper example to his men. If he don't do that no system of punishment will get discipline for him. So the primary thing is for the officer himself to realize his duty to his country, to his division, his regiment, his battalion, and his duty to himself; to maintain the very highest ideals of professional ethics and professional treatment of your patients. If you don't do it you will never get discipline out of your men, and I tell you you need all the discipline you can get. Absolutely. Don't forget that warfare—combat—is destruction; destruction of a personal and material nature; moral destruction; destruction of everything; and troops in combat do lose their personality, they do lose their material, and they do lose their morale. You take the best division that ever was and put them in a hard-fought battle and they lose the men killed, they lose material destroyed, and they lose morale. It happens right along. And unless you have discipline, which is not only the recognition of outward forms but really rests on the consciousness of a man's duty, you will never get by with it; you break down right in the middle of the thing. It is up to us as officers of the Army to do every possible thing we can for our detachment, to put discipline on that basis. Absolutely. I tell you you can not realize until you have been in the service long enough, you can not realize how much the enlisted man depends upon the officer under whom he serves. For example, when this hospital was shelled I venture to say that if the officers there had broken and beat it, and run out of there, I venture to say there wouldn't have been five enlisted men who would have stuck. As it was there weren't five of them that didn't stick. They didn't like it; neither did I nor anybody else, but they stuck and stuck right straight through and they did the job absolutely.

Now one thing that I was lucky enough to get in my division was assistance from the line. You know when you get a big mass of wounded the personnel you have in your regiment isn't big enough; you haven't enough men to handle it. So I got a division order in my division assigning eight men from each rifle company to be used as litter bearers during combat. They would be available on the call of the regimental surgeon. We called them out and used them and they were all right. They did the job and did it well, but don't forget that you have to have reserves. Now before you go into the battalion—if you are battalion surgeon—ask the battalion commander for them and he will probably demur and say he can not spare them. They say, "If I give you men for litter bearers there are that many less rifles." That's absolutely true. You can not argue that point. But tell him it is his soldiers they are working for—not you, and that you need them to take care of his personnel, and if he doesn't see it then, wait until after you got in combat. Then he will see it. I have had it happen both ways. But get the men if you possibly can, and use them.

Now there is one man in the division who has the hardest job to my mind of any medical officer in the division, and that is the director of ambulance companies. The direction of ambulance companies is a very difficult, very arduous, and very trying position; and the man runs around in a side car all over the place trying to make liaison, as they say, between the ambulance companies and the regimental medical personnel, and it is up to battalion surgeons to let him know where they are. Let the division surgeon know anyhow, because he can eventually let the director of ambulance companies know; but if you can get in touch with him directly, do it, because he is the man who moves wounded for you and he can not do it if he don't know where the wounded are. He is the man who works all day and all night and

he has the hardest job in the division. My director of ambulance companies says he can tell where he is in France by the taste of the road. But don't forget his troubles, and try, so far as you can, to make them as light as you can by keeping in touch with him and notifying him where you are, and how many wounded you have, and what class of transportation you need.

Incidentally that brings up one little thing and that is the subject of messages. I don't know whether you have had any instruction on that, but when you write a message use that little book for the purpose. The Signal Corps issues it. Gentlemen, when you send a message to the division surgeon to let him know where you are, or to the director of ambulance companies, or whoever it may be, make it explicit, and don't ever, ever send messages like this: "Send some ambulances to Haucourt for wounded." Now I knew where Haucourt was, but I didn't know how many wounded there were. I didn't know whether they were sitting or lying cases. Now that message, therefore, gave me no information. What I had to do was to get the director of ambulance companies to go up there and find out how many patients; how many were sitting, how many lying. What he should have written was "At 25.3, 75-6 I have 14 patients, 6 lying, 8 sitting." That's all I needed to know. That covered the whole thing. I could have handled the situation and would have sent up ambulances for his patients right away. When you write a message of any kind, put yourself in the place of the man getting the message. You know what you mean, but he doesn't. Make them explicit. You can send them by runners, by telephone sometimes, by these so-called buzzer phones; carrier pigeons. You don't hear much about carrier pigeons, but as a matter of fact in this Montfaucon business our best liaison in divisions was maintained by carrier pigeons, and it was the only way in which we were in touch with corps headquarters for two days. But if you can't send any that way you can always send by ambulance drivers, and this is the best way of contact. When we went into this fight my chief of staff ordered me to divisional headquarters, and I ran the whole thing from there, in a Dodge car. I didn't have a soul there except the driver—no clerk, orderly, officer, or anybody; none of my office, none of my assistants. That's the way I worked it—by stopping ambulances, giving the messages to the driver. Now, as I said, whenever you write a message, no matter what it is, make it explicit, giving your location, and make it definite.

Now a minute ago I skipped one thing in talking about discipline. There is one thing that you do want to do. If in an action any of your men have one particularly or markedly good work tell them about it. Don't forget it and don't forget to tell them, so somebody else will know about it. Get the men formed in rank and call the man out in front of the formation, and tell him about it right there. There is nothing that works so well for discipline and esprit as properly distributed discriminating praise for work well done, and if any of your men distinguish themselves in action recommend them for the distinguish service cross. I recommended some of my men and they are going to get it. The beauty about it is this: It is not only good for the man who gets it, but it is good for every fellow who didn't get it. He says, "You watch me; next time I will get it, I am going after it." It is the finest thing in the world, and after this Montfaucon business I took occasion to recommend several of my officers for the D. S. C., and others that I didn't think quite deserved it I asked the commanding general to write them a personal letter and he did—a fine personal letter; and we had them all lined up and I called out the noncommissioned officers and privates and shook them by the hand and told them I appreciated their services. I want to tell you about one case. By the way, I had five medical officers and two dental officers killed in this action. One of my medical officers, a graduate of this school, Lieutenant Marks, battalion surgeon; on the third day a shell splinter came along and cut off his moustache and bit a hole in his upper lip; didn't take it all off, but cut right through here [indicating]. He got down in a shell hole and put a couple of stitches in it and took a dose of A. T. S. and went back to work. The next day he got a machine-gun bullet right across the back of the head—practically through the muscles of his neck. There was a gutter in there about that long [indicating]. He got one of his corps men to put a dressing on it and he went to work and stayed with that battalion, and when it marched out he marched with them on his own legs. He is going to get the medal of honor if I can get it for him. One of the dental officers in the division was recommended for the distinguished service cross and he is going to get it.

Army Sanitary School No. 172.

THE DUTIES OF BATTALION AND REGIMENTAL SURGEONS

By Maj. S. Bayne-Jones, M. C., United States Army, November 25, 1918

In discussing the duties and the work of a battalion and regimental surgeon, I mean to take up the work both from the standpoint of a battalion surgeon and the somewhat larger standpoint of a regimental surgeon. I will limit the discussion generally to a regimental surgeon or battalion surgeon during an advance, during an attack, rather than spend much time talking about the work of a medical officer of that class during stationary action in occupation of trenches.

We have two distinct phases of work. The work of the medical officer in trenches in a fixed position is generally sanitary, and the same rules that you had for ordinary sanitation in the field apply in the trenches, modified by common sense as they are in the field. The principles of your conduct in an operation such as attack will be brought out more by telling about advances than it will be in telling about trench work—that is, if you know how to get along in what is called “open warfare” you can certainly attend to the evacuation and handling of wounded when in intrenched positions.

To speak about the duties of regimental and battalion surgeons in action, in advance, will be the chief purpose. Perhaps it would be well to relate briefly just what a battalion surgeon has to work with in the way of personnel and equipment, and what the regimental surgeon has to work with. A battalion surgeon, has with him a medical officer, an assistant battalion surgeon, and in our battalions 13 soldiers from the medical department. He has 1 sergeant and 12 men; and these 12 men with us, are divided as follows: 2 first-aid men to each company; that leaves 4 men of the Hospital Corps, and we divide these 4 between the 2 battalion surgeons, so that the chief battalion surgeon has with him a sergeant and 2 men; the other battalion medical officer has 2 Medical Corps men. The 2 Medical Corps men with company generally are attached to the company headquarters, and keep in close touch with the company commander.

In addition, the litter bearers are an essential element of the medical personnel of the battalion. At first it was difficult to obtain an adequate number of dependable litter bearers. Until an organization has suffered casualties, the need of numerous good litter bearers is not realized by the commanding officers. When we went in at first—early last year—the litter bearers drawn from the companies were, in many instances, men whose physical and moral defects were often sources of trouble to their company commanders. These litter bearers for several months were made to carry arms. They carried rifle and ammunition, and naturally were used for the duties of armed men. For example, two men were placed on sentry duty in a shell hole post for 36 hours, and were expected to carry wounded men 2 km. Under such conditions the evacuation of wounded was disorganized, as there were no men definitely available to be used for that purpose. One of the duties of a regimental surgeon, therefore, in an organization which has not had casualties or does not realize the need of dependable litter bearers, is to do everything in his power to obtain the assignment of a sufficient number of strong and courageous men for this work. In the 26th Division, after a good many hard experiences, General Edwards issued an order, which I will pass around, allowing to each rifle company 12 privates, detailed as litter bearers, with 6 litters. These are not Hospital Corps men; they are not Medical Department men at all; they are men drawn from the fighting strength of the unit. This order provides, therefore, for 48 litter bearers per battalion. The best way to distribute these bearers has been found to be: 2 per platoon, 4 with battalion headquarters, 8 with battalion surgeon, 4 with assistant battalion surgeon. Two litter bearers in each platoon are sufficient to take care of the ordinary evacuations of the usual number of wounded. It is important for the battalion surgeons to retain reserves of litter bearers at their aid stations. Sometimes one platoon runs into a little more trouble than another. Then a message is sent that more litter bearers are needed there. Now if we have all battalion litter bearers spread out among the companies and platoons, the surgeon can not help that local situation. If, however, the surgeon has a reserve of 4 or 8 bearers, these can be sent out as needed to some particular area. They return to the surgeon's reserve again when they return with the wounded. These litter bearers are also very useful in an advance to carry forward supplies.

It has been my experience that litter bearers drawn from ambulance companies or hospital units and put into platoons and line companies in trenches, or in attack, don't do as well as the men taken right out of the line. When a man's "buddy" is detailed as a litter bearer he is going to take better care of that particular group than a man not quite so personally interested. Litter bearers are drawn directly from the platoon which they serve. They live with their platoons, know their men. They are devoted to their platoons, and if they are courageous men they are highly respected. The service from such men is beyond praise.

The personnel of the regimental surgeon's office usually consists of a sergeant, first class; a sergeant, and 3 or 4 enlisted men. In an advance it is best to leave the sergeant, first class, at the rear echelon of the regiment, where he will be able to compile reports and keep up the paper work of the office. The remainder of the regimental surgeon's personnel should accompany him in the advance, to carry supplies, assist in dressing wounded if there is a regimental aid station, and to act as messengers.

Now for equipment. The battalion surgeon has a very heavy medical cart which usually can't be pulled by the mule hitched to it. It is filled with a great deal of equipment which in actual experience can not be brought up to the front line in an advance in time to be of use. We found it necessary to carry equipment forward by hand. The amount of this material, therefore, had to be reduced to a minimum. Splints were tied together in bundles and dressings and other necessities were packed in sandbags. In most cases each battalion surgeon with his party of Medical Corps men and litter bearers carried forward the following supplies: 4 or 6 Thomas leg splints, 4 hinged arm splints, 12 wire ladder splints, in 4 or more sandbags, dressings, such as medium shell dressings, first-aid packets, doses of antitetanic serum, triangular bandages, packets of gauze, safety pins, bandages, rolls of cotton, adhesive tape, iodine swabs, packages of sodium bicarbonate, and tubes of chloride of lime. Now with these splints tied up, these dressings packed in sandbags, you are ready to go forward; you have your equipment with you, you don't depend on any cart that will never get to you, and you have enough to work on until supplies begin to come forward from the rear. In addition our division surgeon has ordered that each litter bearer be provided with a corps belt, in which he can carry a lot of supplies that you see there:

Contents of litter bearers hospital belts

Pocket 1 (front compartment):	
Plaster, adhesive, 5 yards by 1 inch.....	1
Tourniquet, field.....	1
Ammonium hydrate, ampoules, 4 in box.....box..	1
Pocket 10 (front compartment):	
Safety pins.....dozen..	1
Bandage, gauze compressed.....	4
Pocket 2: Iodine swabs, 6 in box.....boxes..	2
Pockets 3, 4, 5: Individual dressing packets (par. 949), 2 packets in each.....	2
Pockets 6, 7, 8, 9: First-aid packets for shell wounds, 1 in each.....	1

With this material you can do pretty well for a day or so until things begin to come forward.

The duties of a battalion or regimental medical officer are about 1 per cent purely medical; the rest of the work is almost entirely nonmedical. There are more military than medical matters that are of the greater concern to the surgeons. What I would like to emphasize chiefly is that the chief duty of a medical officer is to get all the information he can about his regiment or battalion. It seems hardly necessary to say it, but the regimental or battalion medical officer must live with his battalion or regimental headquarters. I have known one case of a regimental surgeon who didn't live with the headquarters. I have known battalion surgeons to live with their headquarters. If you don't get along with the commanding officers in an informal way you can't do anything. This regimental surgeon I know of wrote excellent letters; he would "cover" himself with any amount of paper, but he never received any information except when his letters were answered, and that was generally a day or so

too late. I speak of that because the surgeon must have all possible information at all times. You have to know the regiment. The regimental surgeon is the chief one to get information for the medical department of his regiment. He should know if possible the plans of the division; he should know the plans of his regiment in battle; he should know exactly which battalion is going to make an attack, which in support, which in reserve; what organization is going to be on his right and on his left; what his communications are to the rear aside from simple communication to the rear by ambulances, because his messages usually must pass through the message relays of the line organizations, through the military commanders. The best policy is to be as good a friend as possible with the intelligence officers. There is one in each regiment and battalion. All the operation plans and orders for advance come to this intelligence officer. He is also the man that distributes the maps. Now nothing is laid down in the usual divisional distribution of maps that will allow medical officers to have maps. Unless the surgeon is in close touch with his commander or the intelligence officer, he will have great difficulty in obtaining maps. Lately by working with the intelligence officer, going with him to division headquarters when he went for the issue of maps, and by keeping in touch with the intelligence officers we were able to get a map not only for the regimental surgeon but also for the battalion surgeons.

Speaking of maps brings out a matter for medical officers that should be well taken care of in preliminary training; namely, the ability to read a map. We have had medical officers who really couldn't go out of a dugout without getting lost although they had maps in their hands.

Obtaining information of the plans of the regiment, plans of the battalion, is a primary duty, and the regimental medical officer can get that best from regimental headquarters. It is his next duty to pass on this information to the battalion surgeons. This can be done best, not by writing letters, but by seeing the surgeons concerned and talking the plans over on the map and on the ground. The surgeon's next duty in the collection of information is to know the sector. The regimental surgeon should know every bit of the sector occupied by his regiment. He has got to get out and go around there and by personal reconnaissance obtain information about the sector. This personal knowledge, in the first place, will fit him to correct the maps. A lot of the maps for regions over which you might advance have very pretty roads marked on them; when you get to the ground, however, you can't find the road. Lots of maps will show roads running through No Man's Land since 1914, and I have seen routes of evacuation planned over those roads when the roads didn't exist. Unless you have been over the ground you will presume that many impassable roads are open. I saw a battery commander in the St. Mihiel battle with a map showing a road due east nicely marked out. He was attempting to take his battery down that road. But for three years the French had a trench along that road, which has been bombarded so that the road was almost obliterated. You have to know the sector, the ground; you have to know where everything is, just what the ground is like, and have direct information from observations. The regimental surgeon must know also where every important unit in his regiment is located—not simply where his aid stations are, but he must know where platoons are located, where small posts are, and then by looking over the ground he will nearly always be able to pick out a suitable location for the aid stations. There are a number of things of this kind which you can only learn by direct observation.

The arrangement of aid stations preparatory to an advance must be made with two objects in view: (a) Ease of access to wounded coming in from the front, (b) ease of evacuation to the rear. The advance aid station should be in the point of departure of the attack. The battalion before an attack is served already by an aid station which may be a little in the rear of the front line, but it is necessary to have an aid station in the very front line when they go over the top. When the attack begins, this station will be ready to take care of the casualties which occur at the start and will receive casualties occurring during the first 500 or 1,000 yards of the advance. It should be placed conveniently to the route of evacuation to the rear, convenient to a wide trench, convenient to a path or an old road, so that litter bearing to the rear will be as easy as possible. But if you have a choice between a place in the center of your troops that was not on a road or path or an easy route to the rear, and one over on the flank near a good road, it is better to put the aid station near the

center of the sector. The position of the aid station should depend also on the direction of the advance, because men and wounded, walking wounded, and litter bearers, will tend to come back over the road they have taken forward. All the men, stretcher cases and walking cases, will automatically go back over the direction of the general path of their advance. It is most satisfactory to get an aid station in the line of natural drift to the rear. It is also useful because prisoners are brought back generally over the line over which the battalion has advanced. These prisoners should be used to carry the wounded back to save your own litter bearers.

It is necessary in preparing for an advance to arrange portable equipment for the establishment of advance aid stations. The necessity for carrying forward this equipment by hand is apparent to any one who has seen the ground that you have to go over. You can't count on any wheeled traffic getting forward of old trenches or of any service at all for nearly 24 hours. The orders are generally issued for the engineers to begin immediately clearing roads, but they meet a lot of obstacles that can not be removed quickly. Shell craters take a long time to fill up; the boche now have a habit of digging holes in the road about half as big as this room to stop tanks; some of those things it takes days to overcome. You can not count on any wheeled transportation coming nearer than 3,000 yards of your advance within 24 hours after you have moved. It is necessary, therefore, that the battalion and regimental surgeon plan ahead and actually carry supplies in bundles and sandbags.

The other proposition that I haven't taken up yet is the liaison with ambulance companies working in your rear. With us the ambulance company furnished litter bearers to work back from the battalion aid stations to the ambulance head. They furnish a large number of litter bearers. The group we regularly have is three squads under noncommissioned officers; that is, 12 litter bearers with 3 litters under a noncommissioned officer drawn from the ambulance department. The duty of these men is to carry patients only from the battalion aid stations to the nearest ambulance that can get forward. Sometimes their carry is very short; sometimes (during the last month or so) they had to carry, at one time, nearly 6 kms. It depends on where the ambulance arrives. You should arrange with the ambulance company, the commander of the ambulance section, to have 1 noncommissioned officer and 12 litter bearers go with the battalion surgeon to evacuate his dressing station. The regimental surgeon keeps with him one or two squads of ambulance litter bearers so he can follow when necessary. It is the duty of the battalion surgeon to see that these men are with him, that they are properly taken care of, that they have shelter and do their duty. The duty of the regimental surgeon in that respect is largely to keep the ambulance companies posted on the moves of the regiment, giving the ambulance company commander every bit of information possible as to where the regiment is, how many casualties, and so on.

The duties of the regimental surgeon so far stated have very little to do with the actual handling of cases. My idea of the work laid out for the regimental surgeon is that he should not be a dresser of wounds during an advance but a supervisor of the work. He should be free to go about to see whether the battalions are properly supplied with medical materials, to obtain and circulate information to the battalions and to the rear. This brings up the question of the regimental aid station. Some surgeons prefer to have a regimental aid station; that is, a station where the wounded from the regiment are brought after they have been attended to at the battalion station. This is generally not necessary. A regimental aid station is generally a useless block in the line of evacuation between the battalion station and the ambulance dressing station. There is very little that a regimental surgeon can do in this way to aid the battalion surgeon. Occasionally, however, a regimental station is necessary as a sorting station. Last July we had such battalion aid stations that the wounded could not be gotten into them properly, and the battalion aid stations were places little larger than fox holes. Most of the time it was impossible to light a candle or to have any light at night because there wasn't sufficient shelter to cut off the light. In a situation like this the regimental surgeon, who is generally in a more protected spot, should have a place where there is more shelter in which wounded can be properly handled. In most of the conditions, however, a regimental aid station is a useless block in the line of evacuation.

The duties of the battalion and regimental surgeon, as I pointed out, are a good deal more military than medical.

STUDENT. I want to ask how many Thomas splints do you supply yourself with?

ANSWER. Each battalion surgeon carries 2 or 4.

STUDENT. Is that sufficient?

ANSWER. Yes; we can generally handle the start off with that. By the time you have used two Thomas splints per battalion surgeon you have other material coming up.

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ORTHOPEDIC PROBLEMS OF THE AMERICAN EXPEDITIONARY FORCES

By Col. Joel T. Goldthwait, M. C., United States Army, senior consultant of orthopedic surgery, A. E. F., December 2, 1918

That which I have to talk to you about this afternoon has to do, of course, primarily with the Army organization and that which the division of orthopedic surgery has to offer the Army—the Medical Corps—but I also want to try to interest you in some of the principles that have been worked out, because of the advantage which these principles are bound to exert upon civil practice. It seems to me that one of the most obvious things in connection with this war experience is that we are never going back to the same conditions in our civil practice that we have been willing to follow before. Certainly the treatment of the industrial accidents at home is never going to be on the same plan that it was before, and if I am not mistaken the experiences that we have had over here mean that the services in our civil hospitals have got to be pretty much revised all the way through. Now the reason for a good deal of that is this: The one thing that the Army is interested in, and the one thing that the public is really interested in, which concerns pensions and all sorts of other things, and the one thing that the man is interested in is, What can he do with himself when he is through with that which the Medical Corps can do for him?

Now once upon a time, of course, in the Army organization, the policy was simply to get the man out as soon as you could after he had been injured, but with the immense number of casualties which the British and the French Armies had—the German Army also—of course it became absolutely necessary for them to think in terms not of just the immediate treatment of the wound but of such treatment that would insure that man being the least burden to the nation and also to insure to the Army the return of the greatest possible number of men to the ranks for further service. Now it would have been absolutely impossible for the British and the French Armies to have been maintained at their proper strength—the same thing is true of the German Army—it would have been entirely impossible for them to have maintained their Armies at full strength had it not been for the work of the orthopedic corps, which took on its new function of getting these men as nearly perfectly well as possible. In the British Army it was demonstrated that nearly 75 per cent of all the wounded men were returned to the line or returned to the Army for duty after their treatment had been completed. That made it necessary to plan treatment and care entirely different from the ordinary care which the Armies had previously considered necessary; and in the British Armies after two years of experience with a great many noneffectives, the British turned to Sir Robert Jones, the orthopedic surgeon at Liverpool, and gave to him practically the whole responsibility for trying to fix over these smashed-up men and to see if he could not do something in the way of returning these men to duty. Entirely apart from what it meant to the man himself, the British nation needed man power, and it turned to Sir Robert Jones to work it out. He took it up, with the result that nearly 75 per cent of the wounded men were returned to the service.

Now when war was declared by our Government against Germany, so that we were really in the game, of the two first requests that came for help from this side, one was that our Nation send over to help the British, base hospital units, and the other that we send over to help Sir Robert Jones, orthopedic surgeons. These were the two greatest needs which the British Empire had at that time. It was my function to be asked to get together a group of orthopedic surgeons and come over with them, study the situation and then plan the organization for our own Army; and 20 men sailed to England within a month of the time war was declared and were assigned to British orthopedic centers; and that group of men has been the nucleus

around which practically all the structure of the orthopedic organization which we are using in the American Expeditionary Forces at the present time has been built. We picked our men in the first place because of unusual fitness, and then the training which was given them which they have been able to offer to the American Expeditionary Forces was derived very largely from association with work carried on by the British.

Now, as you will see as we go on, the work of the orthopedic surgeons in the army game is of very different importance from that which is considered true in civil life. In civil life the number of cases that are orthopedic cases are relatively small, while in a military sense, especially in combat, the number of cases that are orthopedic is very, very large.

Now the work of the division of orthopedics divides itself quite clearly into two parts; one of which has to do with getting the men fit for combat or full military duty, and the other for taking care of the men and restoring function after they have been wounded. There are two perfectly distinct parts to the work. In the first part—that which has to do with the precombat or training period—the problem there consists in getting men physically fit, so that the human machine, which if used rightly will stand a tremendous strain, is ready for the strain when it is put on. In a nation that has developed as our Nation has, with its educational system based practically entirely upon the intellectual side, paying no attention whatever—except in isolated cases—to the physical training, physical education, of our people, it resulted when war was declared in our having a group of young men whom were physically far from being fit for anything like the physical effort that would be required for military training. As you probably know, if you remember the figures, in the first draft that was made, the first draft of the Army, 19 per cent of all the men that were examined were considered unfit for service because of flat feet alone. This is just one physical defect. Nineteen per cent—nearly a fifth of the total of our young manhood. Of course, besides that there were a lot of other conditions.

The way in which the problem over here developed was as follows: The first units that were sent over here—the 1st, 2d, 26th, and 42d Divisions—were made up partly of so-called Regulars; and of course the Regulars were simply skeleton units of regiments and the personnel was largely volunteers, some of whom had not had a gun in their hands until they were put on ship. They were not trained men; they were just volunteers. These four units that were sent over here were in such condition and had so much difficulty with feet and backs that unless there had been some method worked out for handling the conditions we would have had just about as many going back to the States as coming over. Of course not literally so, but the number that would have been scrapped because of feet and back troubles would have been such a large per cent that it would have been very difficult to maintain the units. That led to a study of the problem and deciding upon a plan that was applicable, not to an individual, but applicable to groups of men, where you were dealing with them by the hundreds and not by fives and tens. It became quite obvious as the thing was studied that the flat feet or weak backs which so many of our young men have is nothing but a question of the use of the body, and flat feet is only the result and not the primary condition of the way the body is used. If you will study the anatomy of the human body you will see that if a person stands fully erect the muscles of the feet and lower leg are in such position of physiological tension that the bones of the feet are held in position and you need have no anxiety or concern regarding weak or flat feet. Flat feet are due entirely to the way the body is used, and the treatment consists in showing the man the proper way to use his body. If you view it that way your problem is a simple one. A man with flat feet should never be on sick report; he should not be in hospital because of that. It is a question of training and not of medicine, and the moment you put it there you relieve your regimental surgeon of an enormous amount of work which otherwise comes on sick call. You put the soldier where he should be; you make him understand that it is his own fault; that if he will only do certain things he will get over it. If he has trouble with his feet he should stand up straighter, and you eliminate him from that group of weak-footed, flat-footed men that have been such a nuisance in the Army up to the present time. Now the problem was presented in such magnitude last winter that it became necessary to do something—not for individuals, but groups, and after working the thing over it became obvious that the best thing to do was to take in charge these men with weak feet and badly poised bodies; the chap that we have seen so much at home that we have

rather prided ourselves on; the college man who has stood straight and hasn't acquired a slouch has been considered a crank, the man who stood up straight was the man made fun of. Now the human body was never made to be used that way; and if it is, it isn't a question of him having flat feet, it is a question of inevitably having flat feet.

Now the problem as it was worked out was this: The men were assigned as they came in, those with trouble with their feet were assigned to special organizations; they were segregated put in by themselves, and a camp was started to see what could be done with that group of men. To give you an idea of the magnitude of the work in these early units; there was one 28-hour period of military maneuvers last winter with one battalion, and after the maneuvers were over—only 28 hours—there were 138 men sent to the hospital out of one battalion, with trouble with their feet. That was out of one battalion alone, and it was not a whole battalion at that. One hundred and thirty-eight men after only 28 hours of manuevering, and they were not hard maneuvers at that. The commanding general said they were only simple maneuvers. Well, if our Army was going to be based on that type of manhood there wasn't much question where the end was going to be. Now these men were put in a special training organization. It wasn't a battalion organization, and that name for it was not right, but that was the best we could do. They were there told how to use the body, told the way the human body should be used when a man is standing up, with his body fully erect, with the chin pulled in, with the weight on the balls of the feet, as it inevitably has to be if the man stands erect with his chin pulled in. If you stand that way you get the spring and the stretch of the feet and the muscles in such physiologic contraction that they hold the bones together and it is the position of ease and not of strain once you have learned it. It was explained to the men and they were told why. They were made to realize that the way they stood was the cause of the trouble with their feet and that the cure was to get the carriage of a soldier. We told them to pull in their chins and explained that they can not "suck up their guts"—which the drill sergeant is always talking about—unless they pull their chins in. You can hold your head forward as much as you choose and you can not suck or pull in. On the other hand, you can not pull your chin in without pulling yourself in here [indicating] because the suspensary ligaments of the diaphragm are fastened to the base of the neck or pericardium, these ligaments come up to the sides of the cervical spine and are fastened to the center of the diaphragm, and you can not pull yourself up here [indicating] without pulling the chin in, and you can not yawn with your head forward; no matter how hard you try, you have to get your chin back. You can not sigh with your head forward. Now this is explained to the men as a simple piece of mechanics, to breathe rightly, to get the digestion to work properly, to stand up straight. We worked out a short talk which the men could understand, and the orthopedic men gave that talk to the group and they went over the units, and these men that had actual trouble with their feet we put by themselves, and they were worked specially. They had snap parades, with manual of arms, squad drill, all the other things, always from the proper position, keeping the men standing up straight, and starting from that position, with the body rigidly erect, quick, snappy movements—hep, hep, hep—quick, snappy actions, making the man realize if his feet are weak he must make an effort to "toe in." If there is much difficulty and his feet have spread very much and you have marked weakness, the heels are raised so that the man stands with his feet inclined down. From that position the man walks properly, and you make him realize that in walking he should walk with his feet pretty nearly straight ahead. With the cases that already had flat feet, there, of course, it was a question of treatment. What could you do to correct that? Of course, the man with the flat foot wasn't the man who could be depended upon for a long hike. Therefore, he had to have some special treatment, and the treatment that was worked out for him had to conform to military needs. You couldn't make foot plates, even if you wanted to, and if the foot plate is worn once it means forever; and the Army, in the first place, couldn't provide foot plates, and, in the second place, the principle is all wrong anyway. While in civil life you may have to do that because people will not pay attention to instructions, here we had that large group under authority where we could say, do such and such things; and the result was that after the period when we were in training over here, practically all these men were returned to duty without flat feet and fit for whatever service was required of them. Now the treatment that was given the whole body together, as I said, had to be in accordance with the military

idea and with the materials that we could get over here at that time, and the thing that was worked out was an ankle strap, like this [showing].

Now, of course, when the weight is on the foot and the foot is relaxed, the foot inclines to the inside and the cuboid will be pushed to the outside. Now the cuboid is the bone that represents the corner stone of the body; it should be under the tarsal bones and the weight should come on this [indicating], and with the cuboid in place you never get flat feet. On the other hand, if the foot spreads, as it does when the arch drops, the cuboid is pushed back to the side and then you can not help but have flat feet, and you will never cure the condition as long as the cuboid is there. It is absolutely impossible. If the cuboid is out of place you will always have the foot wrong mechanically. Now to cure that we simply made a strap that would go round the foot—of course the strap is worn right over the stocking. This is an ordinary piece of goatskin which was the only thing we could get at the time. These are made of pretty much everything, and I can't tell you of the number of straps that we have made that have been used by our men. This simple strap comes directly over the cuboid, comes up past the fifth metatarsal, and then comes round the ankle directly behind the inner malleolus. There is a depression beyond the inner malleolus. There is nothing that will do the man more good. He can march all day with that; every time he steps he steps into a stirrup; it does not interfere with the muscle action, but it is simply giving him a little added support, taking the stretch off the ligaments, giving the muscles a chance to do their work, and little by little the foot comes back to proper shape and the condition of weak feet or flat feet is corrected. Now that simple strap, which we call the figure eight, is the best thing for flat feet, and it doesn't matter whether it is in the military game or civil practice, because that gives you reason to believe that the thing will ultimately be correct, the foot-plate acting only for the time being. Some of our men who had flat feet themselves were put to work making these things, and that is resulting in a saving of thousands of men for work in the American Expeditionary Forces that would otherwise have had to be scrapped.

There is another type of foot difficulty that is very common and the result of the type of shoe that has been worn so much with a pointed toe and especially with a short shoe. This type of foot is spread across the front and affects the big joints and causes more or less crumpled toes. These men always get sore joints; they have to wear a shoe which is much too wide for Army conditions and they also have callouses on the balls of the feet, a very troublesome foot, and the source of a great deal of difficulty to the man and a nuisance to the regimental surgeon. Now that represents, when you analyze it, simply a spreading a stretching of the ligaments that hold the foot together; and all you need is something to hold the foot together that will not interfere with the use of the foot for marching, and that was worked out with these little straps. Now a strap of that kind applied around the front of the foot, just behind the joints, with the buckle placed in the hole which there is just back of the head of the fourth metatarsal, and that buckle will rest there, and the foot is simply held together with no pressure over that joint; the support comes directly back of the joints, and the man walks all day long with his foot held together by the strap, and the mere holding together lifts the three metatarsals off the ground. You can not hold the foot together without lifting the bones in the middle. So if you have the strap there you solve the problem of callouses at once. The moment you hold the foot together you bring this part in [showing] so it don't shift any more. So with these two straps—this for the long arch—you have two simple measures which make it possible to really cure conditions—not only relieve but really cure conditions which have represented one of the most troublesome problems in the Army previous to this time. When you realize that 19 per cent of the first-draft army was exempted from service because of that, I think you will realize what it means. The number to be exempted would have been twice as much if we had only used medical treatment. As it was, before these measures were tried they went to hospital, stayed there a little while, and then back to their outfits. The next hike and they went back to the hospital again. It was a ludicrous proposition—back and forth to the hospital, to the organization, to the hospital, until they were a joke. But neither would keep them. Then the training battalion was organized, and after it got started, these men were all sent there and trained. They were not on sick report. They were drilled, and the drill was military drill, so they were being made soldiers

while being made well. We had some snappy drill sergeants—one was a British sergeant major who was considered the finest thing ever when it came to bayonet drill, and they got into such shape that the commanding general of the 26th Division said, right off, "These will be my best soldiers because you are putting so much emphasis on the form in which the movements are being made." Snappy, quick movements, everything precise; all the flat feet were eliminated practically by that. Of course, with the strap we sometimes had to use the deep heel to throw the man over on to the cuboid bone until the ligaments and muscles had gotten strong. For that reason we had at the camp a cobbler shop, and at one time we fixed a hundred pairs of shoes a day in order to have them for the men when they came in. When these men left the battalion they were expected to take three pairs of shoes fixed that way. One they wore, another went with their pack, and the other to the quartermaster stores. If the man used these he would be fully well and would require no further supervision. That idea has been continued and the necessity for a cobbler shop in connection with the camps has been recognized. The men need them, and if you recognize that idea a great many men and officers who otherwise would be on sick call will be on duty.

Now, here is a longer strap on the same principle, where you make a double turn around the front of the foot and around the ankle, where you want the support before the longitudinal arch on the transverse arch. This makes it possible to get into the narrow-sized shoes which most of our men need, and with a proper use of his body the man in a short time becomes physically well.

Now, the other condition which you find commonly in the period of training or preparation is weak back—the fellow with the crick in the back, backache, and all that sort of thing. This, together with flat feet, are the two natural weak parts of the body. The spine is held together by muscles and ligaments. The bones in the foot are held together by muscles. Therefore, if the muscles of the body are not used rightly, it is an inevitable thing that you will have low-backed men. Not that you may have it; it is inevitable. Just the same as if you use the body wrongly you will have trouble with the feet. One is just as much a mechanical certainty as the other. Now, if a person stands as I am standing now, the abdominal muscles are entirely out of commission. My belly wall is entirely relaxed. If a man hits me a very light blow in the abdomen it will knock me out, because there is no protection, and in this position now the back muscles and the muscles of the spine are holding the entire support of the body. I am now just sticking on my back muscles. Now, the muscles in that position are under strain, and no muscle can hold for more than a certain length of time. You have the same condition if you try to hold out your arm. In spite of your will you can't do it for very long; it will fall of itself. If you stand as I am standing now the muscles of the back are under strain; in a short time they become tired and you change to the other side, the muscles getting more and more tired until the strain is put upon the ligaments, and no ligaments are made that will not stretch after a time if undue stretch is put upon them. Then you begin to have aching in the back, the back being tired, and difficulty in sleeping because of backache, and extreme weariness in marching. You have a large number of men that you see in any military organization with weak backs and feet. These are the two most common things. If you can eliminate them, you needn't worry much about the other conditions. Now, the same things that apply to feet conditions apply to back conditions. The men with weak backs were sent into the training organizations the same as the men with weak feet, and it was explained that the trouble with the back was due to the way the body was used. If you stand erect the muscles and ligaments of the back are all in physiological position and condition. Every movement is made from the correct position, and that position can be maintained for an indefinite time almost free from weariness, especially if you stand with the feet apart a little; a man can keep that position for almost an indefinite time without weariness. Once that is gotten into the mind of a man and he realizes it, he comes in from his hike much less tired than he was before, and it doesn't take long before he carries himself that way naturally. Now, remember that the question of posture is just as easy to train a man for as it is to train a man in any other thing that requires physical effort. The shaping of letters as we train the children is just the same question as training a man to do the manual of arms, just a training of muscle effort, and after he has performed the movement a few times it is done automatically. It is the same with the use of the body as a whole.

Once a man has been well trained he uses his body automatically, it becomes automatic, and he becomes conscious of doing it otherwise rather than conscious of doing it properly. And one of the great things this Army of ours is going to do for our Nation is to put back into our population a large number of strong, healthy men—well poised, vigorous specimens, who are going to be the fathers of the next generation. One of the best things that is coming out of the war is that our manhood are going back to the States and our men back to their homes strong, healthy specimens. There is no question about that at all; and their children will be strong, husky; and we won't have a lot of these poor little kids born into the world that means a constant struggle to keep them here. When you realize the way it has been handled at home you will see many good things coming out of this.

You saw in the paper the other day that among the units first to be demobilized were the development battalions. They said no man suffering from flat feet would be exempted from the service in the Army; they should be taken in and trained and not scrapped, and given a chance; and that idea developed at home into developmental battalions, as they have been called. And now among the first units to be demobilized are the developmental battalions. When you analyze it, that's the wrong thing to do. These men should be kept in longest. But that isn't our affair, and some one missed the real opportunity, but nevertheless the opportunity was interesting. It said 93,000 men in the developmental battalions would be among the first demobilized. In other words, among our camps at home we have 93,000 men who have come in the last draft, and put in there because of weakness. They have had it preached to them that they are just as good as any other men if they go at the thing rightly; they can be made strong, fine physical specimens of mankind just like any of their mates.

Now, just one word on an instance to make you realize the thing I have just said—that once a man has learned to use his body rightly he will never forget it. Now, a number of years ago, a broken-down physical wreck of a man was under my charge at one of the hospitals; he was all shot to pieces, but after a couple of years the man was well enough for duty and he was given a job in our office as doorman and porter, and there he worked for a good many years. One day a British lieutenant general, an old-time British war-horse type of general, came to the office by appointment, and this man opened the door and let the general pass on and indicated to him the room in which he would find me. That was the only intercourse these two men had. The general came into my office and said, "Where did you get that fellow?" I didn't know what he meant at first, and he said: "That fellow on the door"; and then I told him hurriedly what I knew about him, and he said, "I don't mean that. He has been in our Army." I said that I didn't think so; that he had been in our country 13 years, and the general chuckled and said "He has been in our Army"; and nothing I could say changed his opinion. When he went out John opened the door for the general to go out, and when he passed him he said, "What regiment were you in?" John snapped to attention, saluted and told him. John said to me, "How did he know?" I said, "I don't know; he had you spotted all right"; and I asked the general the next day how he could pick a man out that way, and he looked at me with an expression of infinite pity. "Why, once a man has been trained in our Army he never loses it." The only interest he had was the way John was carrying himself. He had been a cripple a long time, but the general saw something that meant only one thing to him and that was that he had been in the British Army; and the only thing that interested him was what regiment he had been in. Now, this war has given us the opportunity to get our men trained so they will not have lame backs and flat feet, and when the country needs them we won't have to scrap 20 per cent right off before we can make them fit for combat. President Lowe the other day made the remark that if our Nation does not see as a result of this war experience the need of putting into our educational system that which has to do with proper physical training of the body, as well as intellectual training, we have missed a very good opportunity. Now, when that sort of thing is realized it means that we are going to have something that will make our men go round, not in a swaggering attitude, which they have been encouraged to do. It is just as much a lack of education as if a man should use an ungrammatical expression. We see it every day, and our medical men have been one of the worst classes—slouchy, setting poor examples. And it means that if we go round setting the proper example we will see an improvement in conditions, and flat feet will cease to be, weak backs or knees will cease to be, and with that a lot of other things. But

this is not for us to talk on now. The problem is to keep a large number of men fit for military service, so they can be counted upon when the march is on, and not fall down the first time.

Now, to give you an idea of the difference between organizations in which such methods are followed and those where they are not. One regiment had had regular training of this general sort; another regiment had had no training. They were sent out on hikes, a 10-mile hike. The regiment that had been trained came in almost to a man; the regiment that had not been trained brought in over 300 men on ambulances and motor trucks—on a 10-mile hike. Now, it hardly needs any further argument than that. One is a common nuisance and the other is not.

Now, a man going over the top doesn't want to be a man slouchy and relaxed; he wants to be up on his toes, ready to jump, run or hide, or hit; a man isn't at his best if he can't jump or run quickly, and he can't do it there if he can't do it elsewhere. He wants to be up, and then he can hit a blow that has the full power of his body behind it when he strikes.

On the strength of that a great many men have been saved for the American Expeditionary Forces all last winter when there was relatively small call for our men for combat; we were then able to accomplish things and really send these men back as A men, not as C men. In the last four months, however, we have had to change our policy and make a compromise. It doesn't change the principle at all, but it was because of the military necessity. Now, since last July there has been such a demand for men for military units, and there has been such a constant stream of men going through, that we haven't been able to keep the men in training battalions long enough to make them well. So we have had to take the men there and fix them up, and recognize that all we could do was to make them class C men and be sure they were fit for class C. We couldn't make them well; we didn't have time. That meant fixing their shoes, giving them straps, giving them a few talks. They worked by themselves. You couldn't have chosen them for battle, and as soon as we could get them started they were sent back for some duty of C type. Now, the Army began its active offensive in July, and of course it has been kept up ever since until now. It has meant that great numbers of C men could be used where A men could be released to fill up the combat units. For instance, in a very short period 1,200 men were sent at one time in one group to staff the hospitals in the Toul area, men who were not equal to the long strains of combat. One thousand men went for prison guard duty; another thousand for extra personnel duty around hospitals; a lot of these chauffeurs and motor mechanics have come from the training camp, men who have had suitable technical training but whose physique was not up to combat. So we had to use the camp not as a place to make them fit but to show them how to get fit, and a sorting station for work they could do. Then the men were used for our splint teams, were taken from the training battalions; not equal to combat but perfectly satisfactory for the kind of work we were giving them to do. Now, the average man, you see, isn't yellow; he isn't a quitter; he wants to do the thing, but he physically hasn't the stuff in him. The minute you put the thing up to the man and make him realize that it is a weakness of which he ought to be ashamed as much as any other weakness, and take him off sick call, the quicker he will overcome it.

There was a remark made to me a few days ago by a man who has studied the situation quite fully: "That while we have lost a good many men over here we have undoubtedly saved a much larger number than those killed, by getting men physically well who would otherwise have been lost in a reasonable period of time." I think that's a very fair statement.

Now, when it comes to the question of combat and the injuries of combat, certain principles have been worked out for taking care of the problem with reference not only to the immediate treatment but with reference to the ultimate condition of the man, and when the thing was studied a year ago last summer the director general of medical services said to me several times, "Remember that your reconstruction work begins in the trenches," and that led to the organization which we will describe. In the first place, in order to meet the needs of the Army that was being planned for us, it was necessary in the first place to have some standard system of splints, or a standard type of splint, that would be used by everyone. You can see it would be useless and hopeless if Smith, Green, Brown, and Jones had their own special splints. The supply department, in the first place, would have found it impossible

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to meet the demand and the wounded man would have suffered, because if he were moved from hospital to hospital and the splints were changed every time, it would be highly harmful for him and he would soon get the idea that nobody knew anything about it. In June, 1917, a conference was held in one of our hospitals then serving with the British, and recommendations were made for standard splints to be provided in our Army, and they were provided in October. Now, in order to make it possible to treat our men properly it was necessary to have splints that were the simplest possible for construction; they had to be made over here and we had only certain materials available. We had to have splints that could be made by any labor and they had to be made by the thousands and hundreds of thousands; and they had, also, to be easy to transport and simple to apply. Of course, in this proposition we had the benefit of the immense experience of the British and the French, and we finally decided upon but seven types of splints, which were to meet practically every need that would come in an army in combat—seven. Now, when you see in the museums the number of patterns of splints that have been devised and realize that it has been reduced to seven, you appreciate what an immense saving that has been to the Army, and what a great advantage that has been, not only to the wounded men but to the cause of medicine in general. Because you see this is a principle that we have got to respect, and we ought to take it back to civil life with us again—that there can not be six or more different ways of doing the same thing that are equally good. That's what we have done in civil life. We have had any number of ways of doing things, and each man thought his was the best. But here, with the help of the experience of the British and the French, we said, "These are the ones we will agree upon." Now, the principles of the splints come down to two very simple ones. One is simply that of fixation of the wounded member so that undue pressure will not be put upon the tissues in handling, and the other that of contraction or the pull on the muscles which have been bruised and are thrown into a state of spasm—contraction; state of the member. So that the two principles of fixation and contraction were the basis of the attempt to get our splints, and the splints which we have adopted have been pretty much the same as those used by the British organization. For the leg we have adopted the Thomas splint, which without question has saved more lives than any other one appliance that has ever been devised. Sir Anthony Bowlby, who has had charge of the British service in the field, said to me the other day: "This is still called the Thomas splint, but some one the other day called it the St. Thomas splint, and I think that's just what it ought to be." Now this splint is adaptable for almost all injuries of the leg from the hip joint down, except conditions of the foot; you have to have something else for that. It consists, as you see, of just this ring and these rods. This brings the pressure down on the tuberosity of the ischium, and this long piece, which can be bent; this is placed on the bottom, to which you tie the extension, which is fastened to the leg. Now, the British have used this splint not only for the treatment of fractures in hospitals but they have used this in the transport of patients, and this splint is put on in the field. We have adopted for our field splint a different pattern because it is easier to apply and meets the needs almost as well—not quite, but almost as well, and well enough so that it is satisfactory. This is a pattern of splint devised by Keller, of the Medical Corps, and by Blake, who worked it out, so it is called the Blake-Keller modification. It is a half ring, so you can use it on either side. It is simpler for packing and transport, and it is quite the thing in the forward area. For the stretcher cases in the battle field this is the splint that we have made standard, and it has been used in all our work since the 1st of last January. This type of splint is very simple, as you see. It is fitted in the back, strapped to the rods, held in place, then the extension is put on the ring. This is used only in the field where the man is picked up, and it must be a splint that can be put on in a hurry, for your stretcher bearers are exposed and you want to save as many of them as you can. You have with a splint like this a splint that can be applied in a very few moments, and with that the man can be handled and gotten to the rear fairly easily. Now, the importance of this is of course tremendous, and you who haven't been at the front and seen the work and studied the thing can hardly appreciate just what it has done.

Previous to the Battle of Arras, in 1917, the mortality for fractured femurs alone in the British Army was 80 per cent in the forward area; 80 per cent of all femurs died in the forward area. Because of the great mortality, just before the Battle of Arras the British started to apply splints in the field. That was the Thomas splint, and trained their stretcher bearers

so that a man could apply a splint like this with extension, with a field dressing, and get away with it in no more than two minutes' time. Now I fancy there aren't many men in this room who can put that on a man with a broken femur and put a dressing on it and tie the slings in two minutes time. They were trained to do that, and our men are trained to do that. Every move counts. Every move must count, and General Thompson, the surgeon general of the First British Army told me their record was one minute forty-five seconds, to get a splint with traction on and starting the patient to the rear. Of course, the importance is obvious to every one of you. These splints have been put on right on the battle field; they have been ever since last January when our men began their raiding parties. And our men rivaled each other to see how far forward they could carry these splints. At first we didn't know how far we should go. But the orthopedic men with the men in the divisions carried these farther and farther forward, until finally when a raiding party went over the top every party carried with it a certain number of stretcher bearers and stretchers and with them went the Thomas splints, leg and arm splint, and they were applied in No Man's Land or the German trenches, wherever the man fell. With such a system of training as was worked out in the British Army, and which has been practically copied by us, it means the difference between a mortality of 80 per cent, such as they had in the beginning, and a mortality of not over 30 per cent. At the Battle of Arras the British Third Army had over 60,000 casualties pass through the casualty clearing station—our evacuation hospital. Of that number 1,009 were fractured femurs, and the mortality in that fight when the stress was the greatest, when they had things working under great disadvantages, the mortality in that fight was cut from 80 per cent down to 30 per cent.

You often see men dying, not because of the original wound; a man may be badly wounded and lie out in the field two days and not be badly shocked when you find him. On the other hand, a man may be picked up a couple of hours after he is wounded and be brought back, however, in great shock. Moving a man around with the bones loose inside the muscles may lacerate the muscles and you tear the blood vessels or the nerves to such an extent that the man either loses his leg from the rupture of the vessels or develops such a state of shock that he doesn't get to the evacuation hospital at all, and that has been so clearly demonstrated as a principle, the need of proper support to control that, that Colonel Crile in his last article on shock, in his short, terse sentences, in his things that you are to do, he says; "Put on the Thomas splint as far forward as possible," and he is talking about shock. Now that is the first principle of the treatment of your wounded man—get him in alive. That's the first thing; to get him in alive and in condition so that the surgeon can operate on him; this is of the utmost importance.

Now in the work of the Third British Army, when they started to use splints they found this condition: Previous to that time the femur cases, not only a large number of them died, but a large number of them when they arrived at the casualty clearing station were in such a state of shock that they could not be operated upon and had to be deshocked before they could undergo operation, which, of course, lessens the chances of recovery and gave the infection a better start. Now in the Battle of Arras not only did they all come in, but every one arrived in such condition that they could perform the operation immediately. This saved shock and the physical damage to the tissue that would otherwise take place. Now that is so important that it has been made a definite part of the training of stretcher bearers and ambulance corps men in all our units, and that has been one of the special tasks of the orthopedic surgeon, and the orthopedic surgeons assigned to the divisions have given a regular course of instruction for the stretcher bearers, and no man goes forward for the wounded who hasn't been taught to use these splints and get away with it, and they have gone just as far forward as the troops have gone. There was a very suggestive and touching side to this feature in front of a machine-gun nest in front of Montfaucon—a lot of our men lying dead, and among them was a stretcher bearer with a Thomas leg splint and arm splint under his arm. As far as our men have gone forward the bearers have gone forward with the things to take care of the men where they fall, and no words of mine can be too strong in praise for these men of ours who have gone up there. A good many of them have been killed, but the work of the corps has saved numbers of men who otherwise would never have gotten out. Our men can put on a Thomas leg splint in two minutes' time without any difficulty.

Now when you get your man into the evacuation hospital: The closing and cleaning of the wound, that is simply surgical, and whether one man or another does it is immaterial. In our organization, the chief of the surgical division has taken charge of the case when he gets to the hospital; getting him there is the duty of the divisional orthopedic surgeons. After he has had his operation performed then the question of putting him up in proper splints begins again and the men try to handle the cases they were responsible for themselves. That didn't work, as they themselves admitted, and the result of that was that splinting teams were organized; and since the St. Mihiel fight as soon as the surgeon has finished his operation he steps aside from the table and the splint team takes charge, headed by one young orthopedic man—most of them have never had much orthopedic training before, but we have taught them how, whipped them into shape, and started a lot of them off with this responsibility. The team is composed of one orthopedic officer and two enlisted corps men, and these have all been men salvaged from the training battalions. They put the splint on, arranged in standard position. Then they see that they are started off right to the rear, or follow them to the wards to see that they are taken care of. From the standpoint of the surgeon he is free when he has finished the operation. He steps to the next table and goes on with his operating. The organization which is now in use has resulted in saving of from 30 to 50 per cent of the output of the hospital. One evacuation hospital stated that they had lost less than 30 per cent since the surgeons have been freed from doing the splinting and are doing operating only, and the commanding officers have reported that the saving in material has been tremendous; they don't lose the time nor material they otherwise did.

Now, in the war game, of course you do not have a patient in one hospital any considerable length of time. At home we expect to keep a patient in a hospital until he is well. You don't do that over here. You have him perhaps a day at this hospital; probably two days at the next one; a day or two at the next, and so on; the man may be in half a dozen before he gets to a base port to go home. It is absolutely necessary, you see, that being the case, to decide upon positions as well as splints in which you will put that man in order to keep him in the best way. If you do as was done in the beginning, put the leg with a broken femur in a Balkan frame, and the order comes to evacuate the case the next day, you can not evacuate him in that position; you have to pull it down. If you have had him up there three or four weeks and ossification has set in, and you pull that leg down, you open it, and many long delays in healing were due to that. Now after having a certain amount of that, we decided upon certain positions that were most favorable for transport; and if you put the man up in that position on the operating table in the evacuation hospital that man can be taken out of the hospital and sent to another place without disturbing the fragments of bone a bit. The positions which have been standardized are positions which will be pictured in the new splint manual, which will be a handbook on the treatment of these things.

Now you can put the man up to 30° inflection with a wound of the thigh, with traction in that position, with your slings over your support, and with traction down the leg. In that position the man can be moved perfectly well, but your Balkan frame is used for convenience and comfort. That man can be moved in any ambulance, he can be taken in a hospital train, or put on shipboard and sent home without once disturbing his fragments. In that way you shorten the period of recovery and you save a lot of cases that would otherwise have been lost. The exception, for the upper leg cases, is when you get a certain number of big, lacerated wounds around the buttock in which you can not use the ring. Then you have to manage it another way. For these we use the Hudson splint. It doesn't help the fracture; it just gives you a chance to sling the leg so that the fragments will not be disturbed as the patient moves about. Usually when you have to transport a man with a big buttock wound you put him in one of the long Liston splints or a temporary plaster of Paris splint.

Now with this small group of splints that I have shown you here you have splints that will meet almost everything that is necessary for army work. I will show you how wonderfully the thing worked when it came to the question of transporting a large number of our seriously wounded men to the States, the reason for sending them being that with the rapid expansion of the Army there was difficulty in establishing hospitals fast enough to take care of the wounded coming on; we tried out a system of handling cases to see if we could get them home without harm to the men. At first it was thought impossible, but the military necessity

said it must be done. When the first group of men were taken down to the ship and put aboard I went myself with the convoy and with the lighter to the ship. We went on board each ship and explained to each ship's surgeons the type of splints which the men in the convoy had, and demonstrated four splints—no more. And I was able to say to them that the only thing they need learn would be four splints and that would cover everything we would send home except the fracture splint. It cut the handling down to surprising simplicity. Now you can not put on a Jones humerus splint wrong end up and you can not put on a Thomas splint and get it very much wrong; they are almost foolproof.

What I have shown you now represents the splints that are standard in the United States Army. They will meet everything required, and it is quite obvious that these same things, that have shown such splendid results, will be used in civil hospitals, and it behooves all of us to learn how to put up these cases. You are never going back to the box extension and T splints if you want to get the best results. This gives you the chance for the best result, and there is no question but what it will be so.

Now there is one simple splint that is used for a large number of cases. That is this so-called Jones-Cabot splint. This is used in a great many cases of gunshot wounds. In these cases it becomes necessary to put them on in such a manner that the function the member will get will not be imperfect. It should be put up in the position most feasible for ultimate function. You put it up in this splint. It leaves the fingers free. It is a very good splint for musculospiral cases and for wrist drop, which is common from all these battle casualties.

Now that we have so many amputations, of course we can make a demand on the instrument makers or start our own shop. That is being planned in the States, and the man who is already back of it is Captain Wilson, who has done such splendid work. This means working out a system that means ultimate function for our men, and the United States means to keep these men in the Army, and under Army control, until everything that can be done in a medical or surgical way is accomplished. When the men go to the States they don't ask how soon they can go home, but they wonder if they will go to a hospital near their town. That's the kind of questions they ask, and the Government has planned an organization so that these men won't have to lie in bed with nothing to do. In the first place they would get out of sorts and would have indigestion and other things. If a man has a hand damaged and has nothing to do but lie there, his hand many times gets stiff because he has nothing to do, but if you can supply him with an occupation, he lies there quietly and has a good time and doesn't get out of sorts, and his hand will heal faster because he is doing something with it; the muscle reflexes will prevent harmful things happening to it. So if you can give him something to do you will get him well in half the time and he will have much more perfect function. I saw a man with a gunshot wound of the hand. He had almost perfect function in his fingers and he was doing something to get the circulation going in the fingers at the time. That proposition has been so much a part of the medical department that it has made it a part of its organization—reconstruction. This is one of the most important things we have; and it doesn't matter so much what you give him, so long as it is something that will help him to use the part that is damaged; and you get him well in half the time and some times less. That's a part of the medical organization, the reconstruction era. You will find it in hospitals where these cases are being segregated in large numbers. For instance, the men are making splints while getting well; and dressings are being made by the men under the direction of aides. That is a very positive therapeutic measure which not only supplies hospitals, but it means that the men are going back to the line quicker, if they are going back to the line, and that they get well with much better function.

That, in general, gentlemen, is the plan and general scheme under which our division has been operating, and I can not speak too strongly in compliment of the men who have done so much of the work and the way the Army has provided things, which are just as important as surgery or nursing. I have a very strong feeling that when we go home and see these wounded men about—as we are bound to—that there will not be very many of them that we will be ashamed of. And I believe that the same principles that we have worked out here must be equally applicable to our civil hospitals, and you and I after this war are going to be judged by the condition of our patient a week after we treat him and not a month or two afterwards and after he has had to go to the Christian Scientist or osteopathist to get treatment. The military need is one thing, but the civil need is exactly the same.

Army Sanitary School No. 177.

THE DUTIES OF DIRECTOR OF AMBULANCE COMPANIES (EXPERIENCES WITH THE 82D DIVISION)

By Maj. R. R. Spahr, M. C., December 3, 1918

Gentlemen, I was ordered to this school last May, but never reached it. I have had to learn through experience, and you men have the advantage of going through the course of instruction here. I don't know how many of you are in the sanitary trains of the different divisions, but it is the only work I have been in in the last 18 months. It is my hobby; I hope to remain in the Army, and hope to do nothing but that. At the present time we are reequipping our men, getting back to the old schedule we had in the States.

I have here maps of the various sectors the Eighty-second has been in since the train arrived in France. I will try to show on these maps where we placed our triages, dressing stations, etc., both in the quiet sector and in what was the most difficult and hardest fight of the war—the Argonne Woods drive. It is understood, of course, in the matter of evacuation of sick and wounded, the ambulance men were responsible for the evacuation of all sick and wounded from the battalion aid station, through the ambulance dressing station, through the triage, and in a great part from triage to the rear.

In a quiet sector such as we had on the Toul front at Montsec, we had practically stationary warfare, and rather quiet; though as Captain Coleman told you, when we were leaving the Toul sector we were relieved by the Eighty-ninth, and the Germans, knowing it, launched a gas attack, which was hard luck for the Eighty-ninth but very fortunate for the Eighty-second and the sanitary train in that we had to do the work and get the experience. In that we evacuated 800 men in 24 hours. In the Argonne we evacuated a thousand a day for several days straight. That was our first big lesson in learning that it was our duty not only to evacuate the sick and wounded from the battalion aid stations, through the dressing station to triage, but to provide evacuation from the triage to the rear by means of additional ambulance companies, generally evacuation ambulance companies and trucks. In a quiet sector with that sort of trench system there was little need for ambulance company dressing stations. On that sector, which was the largest sector we were ever in as regards breadth, we had three ambulance company dressing stations. I can say here that the animal-drawn company has never set up a dressing station as a company. I, personally, do not consider the animal-drawn company a "white elephant," and will reserve a few remarks on that until later. However, in that sector we evacuated the normal sick and wounded through a chief dressing station; we did not have a triage. Two of my dressing stations evacuated to the two field hospitals of the sanitary train which were in the city of Toul and acted in the capacity of base hospitals.

Placing the ambulances, both motor and animal drawn, as we have done in our division, with the regimental surgeons and separate battalions, such as machine gun, field signal battalions, etc., you really did not need an ambulance company dressing station in a quiet sector like that, provided, of course, your triage is fairly well forward, and I think—whether we are to be judged harshly or not—the sanitary units of the Eighty-second were too far forward; and I can say one thing for that: I do not think in the hardest fighting there ever was an officer or man left on the field unevacuated for 48 hours, as did occur in divisions with older names and more experience than ours. On the other hand, it exposed the sanitary train to an unusual amount of shellfire which we suffered from, such as we had at Pont-a-Mousson, where we held the right flank in the St. Mihiel drive. The ambulance company dressing stations were, of course, absolutely essential in the Argonne-Meuse drive. In the positions shown on these two maps here, where we were for five weeks, the fighting strength of our division was burned down to less than 3,500 men. You can imagine what we went through. Out of a division of 28,000 men, exclusive of our Artillery brigade and putting in our Engineers, our four Infantry units and machine-gun units, were reduced to a fighting strength of less than 3,500. In sectors of that sort the ambulance company dressing station is absolutely essential.

Where the sectors became more ordinary, and the fighting less desperate, we could get along with perhaps one or two dressing stations. In the sector back of Pont-a-Mousson we attempted to have only one triage and one dressing station, but the Moselle River split the divisional sector in two and we had to double what we intended putting in. The plan was that there would be one large triage, which would be established by a field hospital company, and one ambulance company on duty from that to the remaining three hospitals which were formed in a group at the hospital base—the gas hospital, the hospital for non-transportable wounded, and a hospital for the normally sick and wounded. That we carried out as far as we could, except, as I have said, the river cut the division in two and we had to double all our resources. That applied to the line as well as to the Medical Department. Unless you have been through it and through the congestion, the jam of artillery, cars broken down, the Frenchmen who don't observe any rules, artillery, ammunition supplies, and ambulances, you haven't any idea how essential it is to get the wounded away from the battalion aid station to the dressing station. There must be some place where patients can be treated, and it is more essential to clear the field of wounded and get them to some station than it is to rapidly evacuate from the battalion aid station to the triage.

When we began the Argonne-Meuse drive, relieving the Twenty-eighth at Varennes, we sent forward with the ambulance companies 160 litter bearers. These were for the purpose of collecting the wounded between the battalion aid station and the ambulance post or ambulance company dressing station, and were not to go over the top with troops. That privilege was sadly abused by a great many of the regimental and battalion surgeons, and consequently the system did not work out as we had hoped. It never really happened that the battalion aid station got to such a point that our Ford ambulances could not reach them or at least come within 500 yards. I might also say that we had very embarrassing transportation facilities in comparison to other divisions, but in spite of all that could be done, we were unable to secure any more ambulances for the Eighty-second other than 8 G. M. C.'s and 4 Fords. The two directors of the sanitary train never had Dodge cars; I have none to-day—I ride a Ford jitney. But we had attached to us one of the American ambulance sections—S. S. U. 647—and if you read the newspapers rightly, you know a great many of their drivers received the distinguished service cross and other decorations. It is the same service I was in two years ago with the French. These men evacuated from the battalion aid station to the dressing station and a G. M. C. carried to the triage, and evacuation ambulance companies furnished by the corps and supply train trucks carried the wounded from the triage to the rear. You can easily put 20 slightly wounded on a truck.

Now comes the question of gas. You have all heard of the rules laid down that every patient supposed to be gassed shall come in on a stretcher, and the men would soon get on to that and we would get a great number of men at a dressing station without a tag perhaps, and we would ask him how he was gassed and how he felt, and he would say: "My sergeant said I was gassed." In the Argonne-Meuse drive we gave up the litters and we handled the slightly gassed on trucks, standing up or sitting down, 20 at a time. That soon became a loophole for the men to leave the line—simply say "I am gassed."

The location of the ambulance dressing station depends not entirely but to a great extent on two things, namely, on the number of patients which you are handling or expect to handle, and, second, on the number of ambulances which you have. But in spite of that, if you had 50 or 60 ambulances, the transportation can throw everything to the winds—you get along just as well with 6 as with 30. That we found to be so. While in the Argonne we had these 20 Fords and 7 or 8 G. M. C.'s. With the corps ambulance companies, sometimes two at a time, generally G. M. C.'s, we were able to handle the evacuation quite satisfactorily. Now as you know, these S. S. U. units, which is the American ambulance service, have very peculiar rules and regulations. In other words, if you ask them at any time to evacuate a sick man from the dressing station to a triage, they kick and say they do front-line work only; and not having any Fords of our own they did the front-line work and we furnished drivers. They didn't have enough to man half of them, so our men were working along with their men. I believe the director of field hospitals will speak to you to-morrow, Major Spear, and I don't wish to encroach upon his work, but I think the divisional triage might be taken up. Previous to the St. Mihiel drive orders were given that there should be one

triage which should be run by one field hospital company augmented by an ambulance company, and in the rear the remaining three hospital companies should form a hospital center.

That we carried out in that drive, and in the Argonne-Meuse drive we did the same thing; even more, we ran a supply depot and base hospital. It so turned out that we were here with the First, Second, Forty-second, and Seventy-seventh, which was then taken out for two weeks, the Seventy-eighth coming in after we had attained the line which runs through Fleville, and the line remained practically stationary for six days. I don't think the whole corps advanced 2 km.; they simply couldn't. As you know, about that time, the middle of October was the stiffest of the German resistance in this Argonne sector, and at the same time our men were literally worn out from influenza, pneumonia, diarrhea, and constant rain, that brought our fighting strength down to less than 3,500 men in our entire division; and this along with the constant shelling and the night bombing. None of us got any rest. But as I say, as a result of that we began to evacuate a large number of sick and wounded toward the end, and our triage developed into a hospital center. By orders of the commanding general we put up tent after tent, and, in spite of the constant shelling, we remained there; and then they put the quartermaster and ordnance dumps there and we were outfitting the men there, in view of the enemy. We also had some of the 77th Division—the Argonne Players were there, from New York City—and we did everything we could to recuperate there. The divisional triage was not intended to become a rest place for soldiers. We were then at this town called Apremont, and there above this town of Fleville—a matter of only 5 km.—we had a dressing station. As I say, this field hospital had a job on its hands—not only running a triage, but a rest camp and the outfitting camp.

The matter of the evacuation to the rear from the triage I think I have already spoken to you about. There was also another thing which we had to contend with in repose, as in the battle line, and that is unreasonable requests for ambulances from both line officers and medical officers. We would get an S O S call from the front for 300 or 400 men; send 15 ambulances. I don't know whether they thought we picked ambulances off the trees or where we got them, but they were not necessary. All the business was done by sending notes by the ambulance drivers, and these men kept in touch with the battalion aid men, and as soon as the battalion aid station advanced we immediately advanced a litter post or an ambulance post to the evacuated aid station and in time advanced our dressing station to that point. We never listened—unless it was an order from headquarters itself, the commanding general—we never listened to any calls for ambulances or things of that sort, and we generally knew how many casualties there were and handled them. And at one time we evacuated the entire work of the 78th Division. Their sanitary train wasn't there. We had 9 of their men to 1 of ours. The same thing happens in repose. You know line officers still adhere to the old idea of an ambulance being used, in spite of what Army Regulations say, for everything—officers' baggage, officers' wives, everything; but up there we didn't see any women so we weren't bothered with them, except in the rear, where we ran across the Red Cross, Salvation Army, and Young Men's Christian Association. We have had the S. S. U. taken away and we got 20 ambulances down here, and we no sooner got them than everybody wanted an ambulance.

A great many questions are still being asked about the use and the function of the animal-drawn ambulance. I remember Lieutenant Colonel McCormick, who visited the division at Camp Gordon last April, and we discussed with him the animal-drawn ambulances of the division. We wanted to transfer the mules and change them for Fords. He said the day would come when we would pray for a shower of mules. I am not convinced, and I think they serve the Artillery, perhaps, but I believe they should be kept in the division and not in the sanitary train. What we have done with them is to place an animal-drawn ambulance with every organization in the division; every separate battalion and regiment has an animal-drawn ambulance with it, and when they move they always have an ambulance. Now, our regimental officers have a habit of writing letters about not getting ambulances. In addition to that, every organization has a Ford ambulance stationed right with it, and in addition our G. M. C.'s make the rounds every day in repose; of course, it can't be done in activity.

The men of the litter bearer section were added to other companies. The company, as a company, has never established a dressing station; they serve the Artillery, perhaps. These animals help out on a great many occasions, but they are a great source of trouble and care, especially when they are short of food, as they are in every organization in France in the American Expeditionary Forces.

Now the camp infirmaries and their personnel, as you know, come under the direction of the director of ambulance companies. Some place them with the regiments, as was originally intended in the Manual for the Medical Department. We have never done that except when the division left for France. Since the division has been in France Captain Coleman has used to very good advantage about 12 to 14 out of the 16 men. There are 8 camp infirmaries to the division. The remaining we scatter here and there. When we left for the line we salvaged the camp infirmaries, and as such they have had no function in our division.

We also read articles—I got them from this school and other schools—about the station for slightly wounded. We never had it in our division anywhere. Generally the areas were too narrow to permit of it. The slightly wounded get the habit of drifting to the battalion aid station, and when the battalion aid advanced we would put in an ambulance post; the men are in the habit of coming through this place. The slightly wounded came there to be treated, and that later represented the point to which ambulances could go, and, eventually, as the front advanced, we worked up a dressing station in there, and the slightly wounded and the seriously wounded and gassed came there, and in my opinion there is no use for a station for slightly wounded as such. From there they are sent back by trucks or heavier ambulances.

There is another thing the battalion surgeons are apt to do and that is to rush Ford ambulances forward of their battalion aid stations. An ambulance should not go forward of the battalion aid station. When the situation is such that they could go forward of that, the battalion aid station should be moved forward; and we made it a rule, a divisional order, that no ambulance should go forward of the battalion aid station. The use of them was abused in that way. Litter bearers were sent forward with the sanitary personnel. Our bearers were for the purpose of keeping clear the territory between the ambulance dressing station and the battalion aid station.

Rules regarding the running of ambulances and things of that sort: Of course, we have had the ambulances outfitted and they keep so many splints, so many blankets so many litters, so many dressings, so many bandages. We have had to adhere strictly to the rules regarding the traffic regulations and things of that sort, and until we got back here two weeks ago we used to travel in the dark absolutely without light. The whistles are a help.

The matter of keeping the oil and gas supplies, the matter of keeping cars and depots, and things of that sort, devolves upon the director as well as the supply officer. In fact, I am everything from a military policeman to street cleaner, but as a doctor the work to me during the past 18 months has been intensely interesting.

Army Sanitary School No. 179.

THE DUTIES OF THE DIRECTOR OF AMBULANCE COMPANIES

By Captain Taylor, M. C., United States Army, Director of Ambulance Companies, 26th Division

I will endeavor to outline the salient features of ambulance company service in a combat division under two distinct headlines, namely: (1) Service in the rear areas, with the division in training or at rest; (2) service at the fighting front with the division in more or less constant combat.

The personnel, both officers and men, as well as the equipment, is, as you already know, definitely laid down in the Manual for the Medical Department, 1916, with such changes as have from time to time been published. There is, therefore, but little of interest to be said as to the prescribed organization of an ambulance company. However, I should feel that perhaps I was shirking a duty did I not speak briefly of those changes which we, who have had rather extensive experience in ambulance company work, feel would greatly improve the service.

There may be, and undoubtedly there are, a great many minor changes which would benefit all concerned and lead to a greater degree of efficiency in this particular branch of the Medical Department, but to me there are two which stand out above all others. They are radical changes and such as could not be accomplished without definite legislation, but could they made I am confident that they would lead to a more efficient organization, a more rapid receiving of the wounded from the field of battle, a more speedy recovery of such wounded in hospital, and the solving of many difficult problems which division surgeons have had to face during the last few months of war.

These changes in organization are, first, the creation of an ambulance company for the evacuation of sick and wounded, with no other function to perform. Such an ambulance company should be equipped with 12 ambulances of the Ford type and with 8 ambulances of the G. M. C. type. There should be four such companies to a division, and they should have sufficient personnel and equipment to enable them to operate independently of all other units. Such a company should be in command of a trained transportation officer, and should be provided with good mechanics and repair men.

The second change of organization which I would propose is the establishment of a divisional battalion of litter bearers; such a battalion to consist of 4 companies of not less than 4 officers and 168 enlisted men each. The function of such an organization would consist in the evacuation of all battalion and regimental dressing stations to one or more main dressing stations operated by this unit. Each company should be complete in itself and capable of operating independently. The divisional battalion of litter bearers should have at all times sufficient truck transportation at its disposal to transport its personnel and material, inasmuch as experience has shown that the work of litter bearers is too strenuous to allow of long marches. These two changes of major importance are but two of the thousands which undoubtedly have been made in the past, and which will continue to be made in the future, so I shall not tire you with the details of them, notwithstanding the fact that there is much, very much, which could be said in their favor.

Let us first consider the ambulance section with a division "in training"—a section of four companies, each having its definite personnel and equipment. How should it function, and how should it train for the more serious work under conditions of combat? First in importance, to my mind, is the establishment of an esprit de corps, a healthy competition between the companies, and a good state of morale which naturally follows as soon as these are in evidence.

It will take intensive training in the school of the soldier, squad, platoon, and company, and a period of weeks and months before a company can be considered in good condition, and I firmly believe that we should go further and maneuver the four companies as a battalion during the period of training for the value of the lessons which it would undoubtedly teach in management, discipline, and maneuver of sanitary soldiers. I am of the opinion that these soldiers should receive more drill, more discipline, and more general instruction than the infantrymen, for are they not training for the specialized form of work? Are they not wholly "on their own" (if you will allow the expression) when they are functioning? Do they not have to exhibit a greater degree of incentive and ingenuity? Their service is so absolutely different from all others that it will require the highest degree of discipline and training as a soldier. They do not have the close supervision the men of the line have; they do not have the excitement of actual combat to buoy them up, still they must work on and often through the worst of the shelled areas with never a chance to strike back, and always and ever with but one thought in mind—that of service. This, gentlemen, takes discipline and courage such as you must put in the mind and heart of every soldier under you would you have him do his full duty to his country and his comrades.

So, let your training of the sanitary soldier be exacting. Teach him self-respect, his proper relation to others, the importance of the duty for which he is training, and as much concerning the other arms of the service as is possible in order that he may be a distinct help in coordinating the work of the different departments and carry out more intelligently such orders as are given to him.

The selection and training of officers is another most important matter, for this particular branch of the medical service requires a different type of man. He must, first of all, be red blooded and have plenty of endurance. He must be interested in the work at the

exclusion of everything else; he must be a lover of out-of-door life; a man with personality and character and one who does his work for the love of service and in order to sustain certain definite high ideals.

Each officer should receive a special form of training and instruction to properly fit him for his duties later for I do not believe the work of these officers to be interchangeable once they are in active service at the front. For this reason we divide our officers as follows: (1) The commanding officer; (2) the second in command, who may be trained to take charge of the advance dressing station; (3) the motor transport officer; (4) the litter-bearer officer; (5) the officer in reserve to be used to reinforce Infantry either in the line if necessary, or for the relief of any of the other officers of the company during times when active combat over a period of days makes such a relief necessary.

Just a few words as to the definite training required by each of these officers. The commanding officer must be a man in whom all others can place their confidence; a man of good judgment, of unquestionable principles, and a man accustomed to the giving of orders and seeing that they are obeyed. He should know Army paper work well, and should so train his office force in this particular that they will turn out their work accurately and always on time. During the training period he must familiarize himself with every little detail of company organization and administration. He must create a definite system of work in each of the company departments such as will lead to greater efficiency. He must personally drill and maneuver his company, and he must not neglect his own education in mechanics if he would prepare himself to command an ambulance company. The commanding officer will personally check all paper work of his office and he should impress upon his officers that first mistakes are pardonable, but that to make the same mistake twice is not. He must give much attention to the subject of map reading in order that he may instruct others in this most important subject, and he must from the very first learn how to control men, provide for their needs, and obtain from them the hearty and freely given cooperation which is absolutely necessary for his own success as well as the success of the company which he is commanding.

The second officer in command must become the understudy of the commanding officer. He must pattern after him, learn his various systems of operation, and in addition prepare himself for the most important duty as dressing station officer. He is the one officer of an ambulance company who can not afford to forget that he is a practitioner of medicine and surgery, and yet this officer must not pay too much attention to the niceties of his work. Rather, he must be a maker of systems, a man capable of organizing teams and a man of excellent judgment. It is his duty to organize the advance dressing station upon a firm basis, a basis which will allow of the passage through such station of the maximum number of cases in the minimum time, giving to each individual care and such emergency treatment as his condition demands. The advance dressing station is not a station for the practice of medicine and surgery, and he who commands it must be able to discriminate between cases which do not require such attention. Time is an all-important factor, and we have no business temporizing with a patient in the advance dressing station unless we can at least see our way clear to bringing about an improvement in the conditions as they exist at the time. In other words we must not move the patient about and make various changes in his dressings unless we can see that such movement and changes in and such rearrangement of dressing will result in a definite benefit to him. Previously undiagnosed fractures must be discovered here and the proper treatment applied. There is no excuse for patients going beyond this point without having received their initial dose of A. T. S. In so far as is possible all cases should receive hot drinks and a cigarette in the advance dressing station, and of these I believe the cigarette to be of the most benefit. In some instances it will be found to be a distinct advantage if primary gas treatment is given at this station, but such treatment can not always be given in the cramped quarters, and it should never be attempted if it is going to produce congestion and consequent delay in evacuating the more seriously wounded.

The training of the motor-transport officer is, to my mind, best accomplished at a motor-transport school. He must be thoroughly familiar with motors, their construction, maintenance, and repair, and he must have had such experience in the handling of evacuation, both by single ambulance and by convoy, as will make him efficient in the supervision of

the entire motor section of his company. During the training period he should conduct a school daily for drivers and orderlies in order that they may receive instruction in the management of difficult situations, in the care and repair of their machines, and in those things of a military nature which they should know in order to function properly.

The instruction and training of the litter-bearer officer is perhaps more difficult than the training of all others. He must be well grounded in map reading, and must be able to lead his men over a difficult terrain during the night as well as the day. He must be a man of courage, a keen observer of everything he sees, a man who can form an accurate judgment hurriedly and who can, from the very first, gain the absolute confidence of those under him. This man should receive instruction in the making and maintenance of contact, in liaison, in rapid deployment and assembly of his men while marching by compass and in every smallest detail of map orientation, map making, and map reading. Lives often depend upon his accuracy of movement, his good judgment, and his willingness to always go wherever he may find it necessary to send his men.

The fifth and last-named officer of the ambulance company should receive such training as will enable him to be used as a substitute for the other officers should they become incapacitated, and, further, to thoroughly equip him for work with the line at any time that he may be ordered in to relieve a battalion surgeon. This officer is, to my mind, the only one that can be spared from the ambulance company, and if we are to train and prepare medical officer for duty with the line organization, then we should have at all times two or three extras, who can be so trained and prepared and sent into the line to fill emergencies as battalion surgeons become unfit for service or require additional assistance at their stations.

Following the training of officers there is no part of your work of more importance than the training of specialists. I refer to those men and groups of men who, when you have actually commenced to function at the front, will make it possible for you to "carry on" under any and all circumstances, and whose work is vitally necessary to the entire ambulance section. These specialists are of three kinds: (a) The pioneer squad, (b) liaison runners, (c) signalmen.

Let us consider the pioneer squad first. This squad is made up from extra mechanics, drivers, or orderlies of the motor section, its personnel being as follows: 1 noncommissioned officer, 1 carpenter, 1 mechanic, and 5 wagoners (privates first class, or privates). This group is trained in the company and later turned over to the divisional engineers for further instruction. Hence they learn to make rapid road repairs, to bolster up bridges, to lay a corduroy roadbed, to remove obstacles, destroy wire entanglements, and the best method of getting ambulances over or around tank traps. This squad operates at the head of all ambulance routes, precedes all other units of the company in going forward into captured territory, and by use of the repair car of the company make their way to whatever point in the area that may require their attention. For this purpose the repair car is fitted out with two planks, 12 feet of 10 by 2 inches, carried on either side resting in the litter hangers. The following tools are always packed in the car: 1 saw, 1 hammer, 2 pickaxes, 3 shovels, 1 crowbar, 2 pairs of wire cutters, and 1 ax. In addition to this, the car carries a few short and long pieces of studding and several pounds of heavy spikes. We have found the work of this pioneer squad most important, and one is often surprised to see how much can be accomplished in a short space of time, and how many, many difficulties this squad will get your motor section out of. They are an actual necessity in an advance of the line where a company finds itself operating over territory which was but a few hours before held by the enemy; and during the more quiet times, even in an inactive sector, you will find this squad, if well trained, a great help to you. The members of this squad must be reliable men; men who are interested in their work and men who are willing to work overtime and under most trying circumstances to increase efficiency of their company.

The next group of specialists are the liaison runners. This group consists of approximately 20 men, drawn in equal numbers from the 4 ambulance companies, and selected because of their intelligence, their aptitude for the work, and their endurance. These men are trained in making and maintaining contact with battalions of Infantry and of machine guns. They are taught to work by coordinated maps, and only through them is proper liaison maintained with the units in combat. They are disposed of as follows: 1 at each

battalion aid station, 1 at each regimental headquarters, 1 with each machine-gun battalion, 1 at the ambulance section message center, and the remaining number at ambulance section headquarters. These men remain in position usually with the battalion or regimental surgeon, and are fed and billeted by him. They are under orders to report to the headquarters ambulance section at least once a day, and more often as the situation may require. Their chief duties are in promptly reporting any change in location of the units to which they are attached in order that the headquarters may never lose contact with the units, but they are also expected to report upon many other things, such as anticipated raids, either by our troops or by the enemy, the conditions and needs of the forward dressing stations, the conditions of the roads and litter-bearer routes, the results of combat, the number of wounded to be evacuated, and, in fact, a general summary of the whole situation in order that the work may be properly coordinated between the ambulance companies and the Medical Department personnel functioning in the line. They frequently bring in messages from the regimental and battalion surgeons, as well as requisitions for medical supplies needed in the forward stations. When the division is out of the line they are used as couriers and road scouts, and in this way obtain information which is always of great value to your transportation officer, and further keeps you in touch with every unit in the division. This last is necessary if you would function as a full-fledged ambulance company and discharge your full duty to the division as a whole.

The third and last group of specialists who will require training to prepare them for work at the front are the signalmen. They are 16 in number, 4 to each company, and they are taught, in addition to the usual methods of signaling, the use of the blinker signal light, its installation, upkeep, and repair. Two of each set of fours are taught how to send messages, while the remaining two men learn to receive accurately. We train two men for each end of the signal work in order to always have a substitute or a relief, should the regular man doing this special work become incapacitated or lost to the company. Signalmen are taken from various sources in the company, the chief aim of the commanding officer being not to deplete his strength in any of the sections. Therefore, we have taken the extra man in the company office, the third cook, which we can do without during times of stress, and sometimes a man from the advance dressing station party or from the motor section who can be spared for the time being. Signals will be found most useful between ambulance heads, ambulance relay posts, and ambulance dressing stations. They must be used intelligently and not more often than is absolutely necessary. When the blinker signal is to be used you should notify all neighboring units, especially the Infantry. In such a communication state specifically where the blinker is located, what code you intend using—the details of why you need a blinker signal in that particular position and when you expect to remove it. All of this is necessary in order that your signals may not be confusing to the Infantry units, who frequently have to resort to this method of communication for the proper control of their own men and officers. You will not find use for these men in every sector, and when not actually operating the signal apparatus they should, of course, revert back to their former work, but when these men are needed they are needed badly, and you will find a distinct advantage in having trained men capable of establishing communication by means of signal apparatus in your units. Signal apparatus is perhaps more often of value to us when we are preparing to care for a planned raid into enemy territory, for the means to rapid establishment of new ambulance heads and ambulance relay posts, and as they are under such conditions but temporary posts, and, further, since it is so vitally important that the work of establishment and withdrawal be made at exact stated time, we must use some form of signal apparatus for rapid communication from post to post.

In addition to all the work of preparation and training which an ambulance company does in a rear area, it must still care for the daily evacuation of the divisional sick, and in some instances various companies may be called upon to form ambulance convoys for the proper clearing of field and camp hospitals to larger base hospitals farther to the rear. Companies are frequently requested to furnish large fatigue details for construction work, road repairs, and service in the hospitals of the division when such hospitals become somewhat congested with sick.

This period is, therefore, one of long, hard hours of work, and the competent commanding officer is one who can, under such circumstances, mold the character of the men under him and coordinate the work of all elements of the company in such a manner as to make it thoroughly efficient and capable of demonstrating such efficiency under any and all conditions. Every soldier must be kept interested and thoroughly cognizant of the great importance of his own particular work, for without this element of personal pride of the service rendered the average soldier becomes an unthinking, and, in many instances, an uncaring individual.

Do all in your power to establish a fine spirit of service, a jealousy of reputation, and a willingness on the part of each and every man to give to the very last of his strength for the company and for the service as a whole. Such a spirit will invariably be reflected in the character of the services which your company performs.

And now, gentlemen, we shall assume that the training and preparation of the company for more serious work has been completed; that your equipment is complete; that your motors have been put into the best possible state of repair; that your office has been cleaned of its work; that repeated inspections of your officers, men, and specialists have demonstrated their fitness for combat work, and that officers and men alike are ready and anxious to prove themselves in that great cause which brought them into their present environment.

Therefore, let us consider for a moment the "service at the fighting front" with the division in more or less constant combat. Although this is the very kind of service for which you have been preparing, still you will find many surprises awaiting you, and many difficulties to overcome which you had not anticipated in your earlier training. Every position which your men go into must be improved; dugouts must be provided, with protection against gas; the overhead covers must, in most instances, be increased; all ambulances must run without lights, no matter how dark the night or how difficult the road; maps of a larger scale than you have previously used must be obtained, or, if they are not to be had, you must prepare a rough map of the territory over which you are to operate. Here you must commence to give your subordinates written orders, rather than trust to their memory the important tasks which you will have to turn over to them. Your men must quickly accustom themselves to the new conditions; they must be contented to work 24 hours a day when occasion demands; eat but two meals during this time, and catch such little rest as they may in a wet, stinking dugout on lousy straw. Your company will, undoubtedly, receive "orders" in which it will be charged with the establishment of its advance dressing station at a stated point, and the entire care and evacuation of a definite portion of the sector front.

You will, perhaps, be given an opportunity to make a reconnaissance of your new position; at least such an opportunity should be afforded you if the military situation will allow. This first reconnaissance should, if properly made, clear up many matters and allow you to proceed with the duty with which you are charged in a businesslike manner. It should be made with a map of large scale in your hand, and from such a map every feature of the terrain should be checked and indelibly fixed in mind. Positions should be selected with the utmost care, always having in mind your chief duty, "the evacuation of the wounded," the protection of your men, and the rapidity of movement which is so important during "rush" times.

It has been customary in our division to charge an ambulance company with the evacuation of either the right or left half of the sector front, another company taking the remaining half, and the holding of the major part of the other two companies in close reserve. These last two companies will, however, often be used to reinforce the two operating on the line, and it is frequently necessary to charge them with the clearing of the two ambulance dressing stations. It will likewise be necessary for the two companies in reserve to furnish litter bearers reliefs, especially during active periods or during raids in force. It is well, I believe, to take all such details in so far as is possible from one company in reserve, leaving the other company in reserve to cover any unusual and unexpected activities which may develop.

Companies of the line should be relieved "as a company" by one of the companies in reserve as often as may be necessary, depending, of course, upon the width of their portion of the sector front, length of litter-bearer carriers, and the general activity of the troops engaged.

But to return to the first reconnaissance by the company commander. He must arrange for the establishment of ambulance heads, ambulance-relay posts, litter-bearer posts, and

litter bearer relay posts. It must be obvious to all then that he should be accompanied by his motor-transport officer and his litter-bearer officer, in order that they may gain a comprehensive idea of the scheme by which he will attempt to carry out his mission. I firmly believe that in addition to this a second and separate reconnaissance should be made by the motor-transport officer and by the litter-bearer officer, the first to obtain more detailed information concerning the roads of the sector, and the latter in order to familiarize himself more definitely with that part of the terrain lying between the highways and well up to the very front. While such reconnaissance is being made all men belonging to the "liaison runner" groups should have been sent out to their respective posts; that is, sent out to find the units assigned to each in order that they may report the exact location of such units at the earliest possible moment. Some of this information will undoubtedly be given you in "location orders" sent out by division headquarters, but in many more instances you will be obliged to look them up for yourself. Once contact is made, there is little or no excuse for not knowing at all times the exact location of such units as you are serving, if your liaison runners have been properly trained and are dependable.

Following the reconnaissance, and after the whole problem has been considered from many angles and the definite scheme of operation within the sector are outlined, the commanding officer disposes of the various elements of his company in accordance with these plans, ambulance heads and relay posts being taken up, the advanced dressing station established, and the litter bearer officer sent forward with his several groups to make contact with and evacuate all battalion dressing stations along his portion of the front. Their location has been learned through information brought in by the liaison runners, and we are now able to place them exactly on the map. These stations are cleared to the ambulance head, which is located as far forward as possible. This is usually a dangerous point, and we therefore rarely keep more than one ambulance here. Below this head, and on the same route of evacuation, is the ambulance-relay post, one or more, depending upon the distance and the needs of the particular posts served. As the ambulance from the head passed down the route, one from the relay post runs forward to take up its position at the ambulance head. If there be two relay posts, a machine runs forward from the second relay post and takes up its position at the first relay post. Ambulances returning from the advance dressing station or from the triage always take up their position at the post farthest from the battle line. The whole system is considered as one "line of evacuation," and it is often quite necessary for a company to establish two such lines in serving one-half a divisional front. The most important point on this line is the establishment of the ambulance head. It must be well selected and with special reference to the litter-bearer routes. Everything possible must be done to shorten the litter carry, for it is most difficult and gruelling work even under the most favorable conditions. It will further be absolutely necessary for the litter-bearer officer to know the exact location of all ambulance heads, and these positions should never be changed or altered in any degree without first notifying him.

All plans which have to do with an advance or a withdrawal of troops, the relief of various units on the line, or the changing of the tactical situations, must be made only after consulting your company officers, for such radical changes are of great importance to them, and you will find it impossible to successfully carry out your plans without their full and intelligent cooperation.

When a raid into enemy territory is anticipated it is the duty of the commanding general to give all details of such raid to the division surgeon, who in turn gives the director of ambulance companies such data as are necessary for the proper covering of the operations. But one must not rely too much on receiving information direct in this manner, and you will often find that the very first intimation of increased activity will be brought in by your liaison runners who have obtained such information through the battalion surgeon and other officers serving with the Infantry in the lines. Here, then, is another bit of most important work which is of vital necessity to your organization, and which is performed by one of the trained groups of men.

As soon as the commanding officer receives such information he should immediately visit the surgeons of the units concerned and here make such plans as are necessary for the proper covering of the movement. He should obtain all the information which there is to be had from the regimental and battalion surgeons, from the regimental intelligence officer,

and, if possible, from the very officers who are to command the units involved. From such information he lays out his own plan of operation, communicates his intentions to all surgeons concerned, and, after making such new dispositions as are required, checks up personally on these in order to make sure that all are in position and in a state of readiness. Such operations will frequently require the establishment of temporary ambulance heads, relay posts, petite postes, and dressing stations, and always, without exception, such additional work on the part of your litter-bearer section as will call for the greatest resourcefulness, courage, and endurance. Every detail must be given proper attention, nothing can safely be left to chance, watches must be coordinated, large-scale maps must be placed in the hands of your litter-bearer officer in order that he may gain therefrom a clear mental picture of the terrain over which he is to take his men, the location of new battalion aid stations established to cover the emergency, the exact points of attack, the purpose of such attack, and the line of withdrawal from the new to the old position should this be anticipated in orders.

Main dressing stations must be reinforced and cleared for greater activity; ambulance drivers and orderlies should be as thoroughly rested as possible to prepare them for the work at hand; mechanics should look carefully to the conditions of their machines; in fact, one and all must do everything in his power to provide against mishaps and subsequent failure of any part of the anticipated operations on the line.

In short, all must prepare for the hardest work they have yet known, work crammed full of excitement and danger to life and limb, and work which is at all times of vital importance to the successful carrying out of the military operations planned. Wounded must be removed quickly from the fighting line if we are to preserve the fighting spirit and morale of those who are left to engage the enemy; and no matter how long the carry, no matter how difficult the terrain, no matter how thick and murderous is the enemy's fire, this must and will be accomplished.

Such, gentlemen, are the duties of the sanitary soldier at the front—a service of self-sacrifice and denial; a service which requires men strong in body, clear of mind; men of determination and courage; men who fully realize how little it matters where one dies, but of how great importance is the way in which one dies. I have seen these men, gentlemen, under the most trying circumstances, and I have yet to see them fail. In proof of such statements I would recall to your mind the wonderful work accomplished by these soldiers of the Medical Department of our Army, at Bois Brule, Seicheprey, Chateau Thierry, in the St. Mihiel salient, and lastly in that hell hole of all fronts, the sector north of Verdun. In these positions the soldiers of the sanitary formation has proven himself a soldier in every sense of the word, his sacrifices have been great, but he has invariably discharged his full duty toward his fellow men and humanity in a way that makes us all proud of him.

The director of ambulance companies should, as soon as practicable after taking up a new position, prepare a comprehensive plan of anticipated operations under the following headings, for the information of the commanding officer of the train, the division surgeon, and all officers of the ambulance section.

- (a) Plan of action in defense of the sector, combatant troops holding present positions.
- (b) Plan of action in forward movement of our combatant troops to the next objective.
- (c) Plan of action in a withdrawal of our combatant troops to a position of defense in the rear.

To prepare such a plan of anticipated operations will require much general information and a most thorough reconnaissance over a wide stretch of territory. Every effort should be made to use narrow-gauge railways and canals, and to determine, in so far as is possible, the exact positions of dressing stations and ambulance heads in the new positions which must be taken up on an advance or a withdrawal. All will not proceed in accordance with your plan. This can hardly be expected, for many conditions will supervene to make changes in the disposal of units in combat, thus making it necessary for you to make different plans for their support. But if you have gone thoroughly into the matter, have made a careful and painstaking reconnaissance, and have used good judgment in the preparation of such plans, you will find them of the greatest benefit to you at the critical moment, and the information which

they should always contain relative to roads, railways, canals, bridges and routes of evacuation from designated places will prove of great assistance to the division surgeon and commander of the sanitary train.

There are many other details with which one must familiarize himself at the front, but these are too varied and too numerous to bring up for discussion here. The matter of "taking over" and the relief of other units who have partially or fully organized the work of the sector are information the details of which every commanding officer should have clearly in mind.

We must never forget our principles of gas defense, and we must at all times and under all conditions endeavor to improve the living conditions of our men, and afford them all the protection from enemy operations as is possible in the full and proper performance of their full duty. Your work of training along these lines never ceases. Even after relief has come and after you have taken up a "position in rest" far from the front, you will find it always necessary to continue your instruction. Let such instruction be made interesting and such as will be of obvious benefit to the enlisted man personally. Teach him the reasons for certain things, and give him such a diversity of mental employment as will stimulate his imaginative powers, and keep him ever alert and ready to absorb all information pertaining to his position as a soldier, thereby making him of greater value to himself and to his country.

Question. How many men do you use on a litter?

Answer. Four, always.

Army Sanitary School No. 180.

THE DUTIES OF THE PSYCHIATRIST OF A DIVISION

By Capt. H. A. Steckel, M. C., division psychiatrist, 26th Division, November 27, 1918

I hope to be able to give you some points which I picked up during service at the front and which may be of value to you in the future. The problems of the war have been many, but none more striking than those due to the extraordinary incidence of mental and nervous diseases, the divisional features of which I shall endeavor to take up with you, based on my experience in the 26th Division. I was first assigned to the division in January, while we were yet in the training area. For the purpose of culling out the undesirables, we opened a psychopathic ward in Base Hospital No. 66, at Neufchateau. This was a prophylactic measure against the development of war neuroses and was attempted in all the cantonments at home in the draft divisions; but as the 26th Division left the United States rather hurriedly and unexpectedly, it was not thoroughly done and many mental defectives and undesirable individuals were found in the division. I saw many—I mean comparatively many. I worked for 10 days in this observation ward at base 66, examining during that period approximately 40 cases. Of these about 25 were evacuated to the rear as being unsuitable for front-line work, and about 15 were sent back to their organizations. We were first sent to the sector in and about Soissons, in the Chemin des Dames region, remaining there about six weeks. During this time only 18 cases of neurosis came through the French psychopathic hospital located behind the lines. The reason for this low incidence of the neurosis was, first, the men were fresh; second, they were brigaded with the French and a certain amount of the responsibility which they later took over rested with the French and the men felt this lack of responsibility; and, third, the sector, as Captain Blood said, was a quiet one—that is, there were no extensive engagements, no heavy shelling at any particular time. After six weeks at this front we came back to a rest area for a supposed month's rest. We were back probably four or five days when we were suddenly ordered to the front and the men, naturally, were disappointed, not only that they did not get their rest, but neither did they get the leaves which were promised them. On entering the Toul sector the first great shelling to which the men were subjected, and which resulted in a considerable number of war neuroses, occurred at Apremont on April 10, and during that time we had the first great number of cases coming through. I have prepared a chart here, which is rather small, but perhaps you can see it sufficiently clearly to serve our purpose. It shows in a diagrammatic way the admission curve of these cases. Now during the 1st, 2d, 3d, 4th, up to the 10th of April you see there were only one or at most two cases admitted daily to our field hospital, which was operating then really as an evacuation hospital in Toul; but on the 10th, at the time that

this rise in the curve occurred, there was heavy shelling and the positions were rather unprotected. We had 13 cases admitted on the 10th, on the 11th, 6, and on the 12th, 11. These were rather severe cases. They were the first real "shell shock" cases (if you will allow me to use that term once this afternoon) we had had in the 26th Division up to this time. The diagnosis "shell shock" has been forbidden, and we now use the term "psychoneurosis," which is better for many reasons. It was there I saw the first real early cases of war psychoneurosis. We were then located in a comparatively quiet sector and our field hospital system was so situated that it was comparatively easy to hold cases at least 10 or 14 days in a field hospital, which is not the usual scheme. We had two hospitals up forward, probably 4 or 5 km. from the line, acting as sorting stations, and two farther in the rear, 14 or 15 km. behind the line, being situated in Toul. The 101st Field Hospital, to which all psychopathic cases were sent, had 600 beds and accommodations that could be expanded up to 800. We usually had between 500 and 600 patients there. Major Thornton and I had charge of the psychopathic cases, and we had three wards which accommodated 75 patients, which was a very excellent scheme. As I say, we could, with such a large capacity and a quiet sector, keep our cases as long as two weeks, and on one occasion where two of the wards were quarantined, one for measles and one for scarlet fever, we were able to keep them as long as four weeks, which gave us an opportunity to study the cases rather thoroughly and also see how long it would require some of the worst cases to recover sufficiently to go back to the line.

The second great number that came through while we were in this sector was during the Seicheprey affair on April 20. The line on the chart shoots up rather high. We had 27 cases on that day, and three or four days later it went up as high as 70. Now the reason for these two curves. The Seicheprey attack, when the boche came over into our lines, threw over a heavy bombardment causing the first curve, and the second slight rise was due to the counterattack by our own troops a few days later. Now I want to call your attention to the fact that of all these cases occurring between the 16th and 30th of April, a total of 133, 31 per cent—that is to say, 53 in numbers—were returned to their organizations directly from the field hospital. Now we could do that because we were allowed to keep the cases 10 days or more—the average treatment for these cases being approximately 10 to 12 days. Following along with this chart as an illustration, we see along here two and three admissions of psychopathic cases each day. That doesn't mean that we have constantly developed the real war neurosis. It means simply, the constitutional defects are beginning to show up and the psychopathies are beginning to be discovered, although perhaps a few are neurosis due entirely to war conditions.

Then on June 16, the Xivray affair, at which time all the areas around that front were heavily shelled, back as far as division headquarters—the town in which the division headquarters were located was so heavily shelled that they had to move—there were 27 cases admitted, and these cases, strangely enough, came not only from the front line but also from the second and third lines, and even from the 101st Engineer echelon, which was located as far back as division headquarters. On the 18th, 10 cases were admitted. These were old cases which occurred on the first day of the bombardment but which were held over at the various dressing and battalion stations before they were sent back, thinking probably they might recover there. We were, I think, fairly successful in the treatment of these cases, in that we got as many as 31 per cent back to their organizations from the divisional area itself, preventing them from going back to the Services of Supply, which is so bad for this class of cases.

After leaving the Toul sector, the latter part of June, we went to the Chateau-Thierry sector, and we saw more cases there; at least more went through our station than at any other time either before or since. We were laboring under difficulties which have since been rectified. The difficulty I want to bring out particularly is the inability to hold the cases in the divisional field hospitals for any length of time. Of course, in open warfare, such as we had at Chateau-Thierry, where the line is moving constantly, it is necessary to keep the field hospitals free of patients so far as possible so that they may follow the troops. We had at that time one field hospital operating fairly well forward as a triage or sorting station; one field hospital acting as a surgical hospital for severely wounded, and we had two field hospitals combined, which were functioning not only as a secondary sorting station or an ambulance

transfer station, you might say, but also as a sick hospital; but because of the activities of the time and the expected movement of the line we were not allowed to hold cases more than three or four days. That absolutely ruled out the holding of any psychoneurosis, because I don't believe there are any of them that will be able to go back to the line in that short period of time. As a consequence these cases were evacuated immediately to the rear, passing through the evacuation hospitals, and on through to the bases. In the period from the 9th of July to the 24th—I made a chart covering that period. We first went into the area early in July, but it was fairly quiet just at that time. The first great number of cases came in on the 14th, at which time there were 21 cases. That followed a heavy bombardment of Belleau Woods, and 6 cases were evacuated by one Infantry regiment and 8 by the 101st Engineers, who were located in these woods and were subjected to this shelling. Almost immediately the curve drops. On the 16th there were only 5 cases admitted, but on the 18th the beginning of the offensive, there were 68 cases admitted, and on the 19th, 74 cases came through our station. Now I think that probably if we had had a place to keep them, practically all of these could have been held in the divisional area, at least saved from going back to the Services of Supply, and returned to duty in an average period of 10 days. But we had no room to keep them; we had to keep our field hospitals clear; so they went back to the bases and were scattered all over France. I might say that approximately 4,000 cases of psychoneurosis, at least evacuated as psychoneurosis, went back through the Services of Supply and were lost in various base hospitals in that period from the 9th to the 24th of July. Our division was not the only one which suffered from this condition of affairs. We had to get our cases back because sick and wounded were coming through and we had to keep moving to follow the troops. About 400 from the 26th Division alone were evacuated during this period.

We then went into rest for approximately two weeks, after which we went back to the St. Mihiel sector. On September 12, the beginning of the offensive, 38 cases were admitted. You will notice the curve shoots up suddenly on that day, and then on the second day only five cases. The troops were moving forward; they were successful; the boche were retreating; and there was no reason for psychoneuroses to develop. The troops were victorious and this adds to the morale, and with high morale psychoneuroses are not so apt to develop. Furthermore, there was no heavy shelling after the first day.

In the St. Mihiel sector we had no field hospital to hold these cases; they were all evacuated to the neurological centers, three of which were located back of the American sector. During the Verdun work, which extended from approximately the 14th of October up to the finish of the war, there were a number of cases that came through, but we were able in this instance to hold many of them in the field hospitals. We had one field hospital operating very close to the lines as a sorting station, and two at the rear acting as sick hospitals, so that we had accommodations for approximately 400 patients, and every opportunity was afforded the division psychiatrist to keep cases for as much as five and six days, in consequence of which 32 per cent were returned to duty during that period. Now it was in this sector that very heavy shelling in all the areas occurred. The Verdun sector is probably the worst that our division has ever been in, and we were in at a time when the troops were not only tired—they had been working hard ever since February, practically continuously—but the weather was bad; they were in exposed places, lying in shell holes three or four days at a time with no other protection, and the shelling was very heavy in all the areas, so that the neuroses came through almost constantly. But there were two days in particular when the curve was rather high. One was on the 16th of October, when 21 cases were admitted, and the other on the 27th, when 49 cases were admitted. On both of these days attacks were made by our division. Of these cases, 32 per cent were returned to full duty, these being rather slight cases and were due largely to fatigue and exhaustion. There has been considerable discussion as to how great a part exhaustion plays as an etiological factor in the production of these war neuroses, but we must admit that a man who lies in a shell hole three or four days with only his iron rations for sustenance, under constant bombardment, has considerable time for introspection, and he is not in the best physical health to bear up under the combined physical and mental strain to which he is subjected.

Now I might say that after the Chateau-Thierry affair, through the efforts of the neuro-psychiatric consultants, three neurological hospitals were located behind the field hospitals, but not considered in the Services of Supply as far as evacuation of patients is concerned—that is to say, the patients could be returned from these neurological hospitals, back to their own divisions without traveling through the base, up through the replacement camps, and all the difficulties through which a man passes when he goes to a base and which are so prone to produce neuroses of a chronic type. In each of these hospitals they had accommodations—Nos. 1 and 3 were directly back of Verdun and St. Mihiel—I think for three or four hundred patients. During the St. Mihiel and Verdun offensives, from the figures I have been able to obtain, which perhaps are not exactly correct but fairly so, there were 2,000 cases admitted to these hospitals, only 600 of which were evacuated into the Services of Supply. In other words, we held up about 32 per cent in the field hospitals, and approximately the same per cent in the neurological hospitals, and only a third of the total number of cases got into the Services of Supply, whereas during the Chateau-Thierry affair they were all lost in the Services of Supply.

Now, why is it so important that these cases should be prevented from getting back into the Services of Supply? The reason is this: These conditions occur, as a rule, in individuals of perhaps a constitutionally mental defective make-up, or at least in practically all of them there is a psychopathic tendency. It is true that neuroses do occur in what we ordinarily call a normal individual, but that question can never be settled because it is very difficult to say what is a normal individual. As I say, these cases as a rule are potentially psychopathic and the further back they go the more pronounced their symptoms and the more chronic are they apt to become. The regimental surgeon seldom sees a well-pronounced episode in a psychoneurotic individual in the front line. It is when he is sent farther back that these chronic symptoms develop, and they are difficult ones to treat, and that is why it is necessary, as far as possible, to prevent these men getting back through the bases.

Now what would be the ideal conditions to handle the situation in a division? In the first place, I believe there should be two men experienced in psychiatry in each tactical division. One to work in the "triage" in order to see the cases early so that they are properly collected and are sent to the proper centers. A certain percentage of the cases, as we have demonstrated before, can be held in field hospitals for a period of 5 or 10 days, and it would be the duty of the division psychiatrist operating at the triage to pick out the most favorable cases, holding them in the field hospital. Then there should be a psychiatrist in the field hospital itself to treat these cases. The man who is working in the triage often finds it difficult to get back to the field hospital—the sick hospital—which usually operated 8 or 10 km. behind the triage, and spend sufficient time there to take proper care of the cases. I tried as far as possible to do that, but I did feel that we would have had better success by having a psychiatrist there constantly. There should be at least 50 beds available in the field hospital to treat these cases. During the Verdun offensive the best conditions prevailed, but even then, with the number of other sick cases held in the field hospitals, we were forced to send back to the neurological center cases that should have remained, because now and then the capacity of the field hospital would be too small to hold all the cases that were coming through. The sick rate was high because of bad weather conditions, and on a number of occasions I was forced against my judgment to send these cases on through to the neurological center.

One difficulty experienced again in the Verdun offensive was that these neurological centers were too far in the rear of our triage—the distance was approximately 40 km. and from our sick hospital at least 30. With transportation facilities poor, we were required to transport patients by trucks in a great many instances. It was difficult to get them back promptly. We usually, in the triages, attempted as much as possible to equalize the loads, to send patients for certain hospitals on certain ambulances in order to conserve gas. The slightly wounded went to one hospital, the severely wounded to another, the psychopathic to still another, and frequently cases would be held in the triage a number of hours before a sufficient number had accumulated to warrant sending an ambulance there. If the distance had been less it would have been a great deal easier to get the patients down more promptly.

Now, in the division itself the psychiatrist can do considerable work, even when the division is not in an active sector; that is to say, during the rest periods he can make super-

ficial surveys of the various organizations, picking out any defectives he may see, and in that way attempt to hold down as much as possible the incidence of the neuroses. And I might say that the regimental surgeon would be of great assistance to the psychiatrist if he would when referring cases to the psychiatrist make short notes on the behavior of the patient, thus giving the psychiatrist a basis upon which to make his examination. When I was making the survey of the supposed defective cases at Neufchateau in the observation ward at base 66 the cases were sent in simply marked: "For observation"; and I had nothing whatever to work on. The men refused to admit that they had had any trouble in their organizations, and it frequently required a number of days before I could get in touch with the regimental surgeon or the line officer to get some information as to why the man had been sent in for observation, because some of them, the first few days in the ward, appeared perfectly normal. So those of you who are regimental surgeons can be of great assistance to the psychiatrist by making a few notes, just a few words—for instance, "Patient has been irritable; disciplinary action has been taken a certain number of times," etc., just a few words, a few lines, to give the division psychiatrist something upon which to base his observations. Furthermore, the battalion and regimental surgeons can assist the psychiatrist during action by tagging the patient properly. There are, of course, a number of forms of neuroses developing under different conditions; some develop without any concussion, others are due not directly but indirectly to exposure to high-explosive concussion, and it is necessary to know the early symptoms in order to diagnose your case properly. Therefore, the battalion man can at least make a note as to whether or not the patient was unconscious when he came to the battalion dressing station, also if the patient revived in the dressing station; he can make a brief note as to whether the patient came to suddenly or slowly, because on that fact at least partially depends diagnosis of the case. If actual concussion occurred it should be noted on the tag.

I will not take up the symptomatology of the psychoneuroses to any great extent, but I will simply go over briefly what we find usually in the cases admitted to the field hospital, particularly because all my work has been confined to that location. The hysterical case may be unconscious. He gives a history as a rule of having been unconscious before he reaches you; he may occasionally be unconscious when he reaches the field hospital. Now, the character of this unconsciousness varies in the various classes of cases. As a rule, the hysterical will have recovered consciousness before he reaches the field hospital. He can give you a history that he remembers the shell breaking and perhaps remembers seeking shelter after the shell broke; sometimes he reaches shelter, but becomes unconscious immediately thereafter, and doesn't remember the trip to the dressing station. He will tell you that he came to, suddenly, in the dressing station or the ambulance station, or, perhaps, not till he reaches the field hospital, but he comes to suddenly and remains conscious. In a true concussion case the unconsciousness is prolonged and he comes to gradually; like a man coming out of ether. He will open his eyes, look about, and lapse into an unconscious state again, frequently repeatedly. Also the unconsciousness comes in immediately the shell breaks; he never has time to seek shelter because he is stunned almost immediately. I will say there are very few of these true concussion cases. Most of them are of the hysterical type.

Regarding the minor forms of hysterical neuroses, I may say that the main symptoms which we noticed in field hospitals were tics, tremors, choreiform movements, anesthetics, and disorders of hearing and speech. I might say I have seen very few disorders of speech in the field hospital, but they may develop as the patient goes back to the base hospital. I have seen a few hysterical anesthetics. The officers we usually find suffer from an anxiety neuroses, the history of a typical case being as follows: He complains of feeling exhausted, that he needs sleep, not having slept well recently and having had disturbing dreams. His dreams are usually of the occupation variety, he having trouble with his men, being bothered by the enemy, etc. If an Artillery officer, having trouble getting the cartridge into the gun, etc. He usually wakes with a start two or three times during the night and then has difficulty returning to sleep. He may go on in this way for three or four or more weeks, but the slightest unusual occurrence will upset him and he will become disabled for three or four weeks or perhaps months, depending upon his make-up. These are the cases that

should be given a rest, either in the back areas or, perhaps, sent on leave before an actual breakdown occurs. The exhaustion neuroses are due purely to exhaustion, and are always slight, show usually only tremors, and recover in a very few days—usually after three or four days' rest in a field hospital. It is rather important, I think, to have field hospitals set up in such location that baths can be provided for these cases, because, usually, after a warm bath, a change of clothing, and a night's rest in bed, these men appear entirely different from when we first see them at the time of admission to the field hospital. There are always a few cases in a division, disciplinary cases, which may be referred to the divisional psychiatrist. A man who has come up for disciplinary action a number of times certainly must be abnormal mentally. His adaption must be poor and we find it is in many cases, especially in our own Army, because we are not a military Nation. We have been picked out of civil life and placed in an environment which is entirely new to us, and it is very difficult to adapt oneself to this new environment. A psychopathic personality has more trouble than the average individual; therefore, these cases come to the attention of the psychiatrist and should be examined with care, as some of them are actually insane, or at least not cases actually deserving punishment for their shortcomings.

Now, I have tried to cover as much as possible the development of the work in our own division and I have tried to explain what might be done perhaps in the future. In addition to these neurological hospitals, which are army hospitals operating behind the field hospitals, I have suggested that a field hospital of 50 beds, known as a psychopathic field unit, be attached perhaps to the division or the corps—a hospital that would operate farther up than the army neurological bases. A unit of this kind with 50 beds could take care of quite a number of the milder cases and in that way not overcrowd the field hospitals, which need to be kept open for other sick and also kept open for movement in case the line goes forward. Any questions?

A STUDENT. Did you find any morons in the service?

Answer. There haven't been very many in the 26th Division. The early replacements which came to the division in April were rather a poor type, but I wouldn't call them a moron type. They were more the constitutionally psychopathic individual—perhaps the farm boy who finds it difficult because of his lack of education, lack of travel, etc., to adjust himself properly. He has never been in contact with many people; he has been brought into a new condition, a new environment, which he finds difficult; but of true morons, there haven't been many over here. I believe they have been culled out before they reached the American Expeditionary Forces.

Question. Did you ever find any acute insanity developing that had to be put under restraint?

Answer. We had one case that came into a field hospital under restraint. He was a case of hysteria and came in on a litter, all tied down with blankets and straps of all kinds, which we immediately removed, and by a little quiet talk and persuasion we were able to overcome his acute excitement. Let me emphasize the fact that the war neuroses is nothing new. We find the same conditions in civil life as well. The symptomatology is the same as we find in civil practice, except that the coloring is different because of the etiological factor, namely, the stress and strain of modern warfare.

Army Sanitary School 182.

SANITARY TACTICS

By Col. M. A. W. Shockley, M. C., United States Army, October 20, 1918

I want to say at the start that there is absolutely nothing new in sanitary tactics; neither is there anything new in combatant tactics. The only things new or in the nature of variations in the combatant principles have been caused by motor transportation, the use of high-power artillery, and the use of poisonous gases in warfare, and, of course, aviation. But tactical principles, either combatant or sanitary, remain exactly the same. If you go into the history of the military service and the history of the sanitary service you will find practically the same old organizations, particularly in combatant service, from the time of written history. The sanitary service was, of course, not organized as a service practically until

the beginning of the present century. The first record that we have of sanitary service is perhaps some hieroglyphics, picture writing, near the pyramids of Sahara, about one thousand one hundred and odd years before Christ, in which there is a picture of an Egyptian soldier receiving first-aid treatment. When we get into legendary history this is undoubtedly correct because the Egyptians did depict historical events in this manner. In written history the first mention is in the Homeric hymns of Machaon and Podalirius, who accompanied the Homeric soldiers to the city of Troy, and in the *Iliad* we find the wounded being treated by Achilles, who seems himself to have been a surgeon, more or less. You will remember in this war Machaon and Podalirius were the sons of Æsculapius, who was the son of his god-like father. He brought doctors who were taught by Æsculapius, so much so that Pluto complained to Jupiter that Hades was becoming depopulated on account of decreased population due to the skill of Æsculapius. There has been no such complaint since that time, however.

The next we hear of sanitary service was some Greek physician who accompanied the Greeks in their war with the Persians about 450 B. C. Then in Julius Caesar's armies we find the battalion surgeon. He is called the medicus, attached to each battalion, and also they had a staff surgeon attached to the legion. That corresponded practically to our large regiment of to-day; our Infantry regiment is the old Roman legion, and our battalion is the Roman cohort, which had a battalion surgeon attached to it. We find artillery organizations and the tactical formations were practically as they are to-day except as affected by increased projectory weapons and high-power explosives, and also motor transportation.

The next thing we have in the sanitary service was the Monkish sanitary surgeon; because after the fall of Rome and the decrease in the wanderings of the Greek physicians, the practice of medicine, and in fact all the sciences, fell into the hands of the clergy, and continued in the hands of the clergy until about 1100 A. D., when at the Second Lateran Council the clergy were prohibited from engaging in secular pursuits, and medicine and the other sciences at large were relegated to the laymen. The laymen were not educated and surgery degenerated to barber surgery, where it remained until about the sixteenth century. At the time of our Revolutionary War there existed the difference between the surgeon and physician. We had a Surgeon General and Physician General, and that continued until some time around 1803, when the Medical Department was reorganized. The medical officers at that time, except the Surgeon General and Physician General, were not military officers. They were civilians, and the medical officers were not commissioned officers at all. They were practically barber surgeons. They had noncommissioned rank. When the Medical Department was reorganized the medical officers were given rank. The Surgeon General issued a bulletin to the newly created officers that they were now officers and gentlemen and expected to conduct themselves as such, and as officers and gentlemen they should resent affronts. The result was that up to 1846, when duelling was suppressed, the officers of the Medical Department fought more duels and killed more men than the Army did. The Medical Department consisted of very little except some transports, but during the Mexican War they had some ambulances. The first we know about was the ambulance wagon. That was organized in connection with the Queen's Hospital, by Isabella of Spain, which she organized for the siege of Alora in 1484, which consisted of about 400 wagons, and the chronicle further states that the nurses that presided were good matrons and not the usual camp followers. So at that time ambulances came into use. There was little before that time.

The British in their expedition against Ireland in 1200 appointed some physicians to accompany the expedition. Nothing was done, however, after the time of Isabella, and the Queen's Hospital fell into disuse, and the old tortoise that the British produced about 40 years ago with roll sides which filled out and formed a tent was substituted for Isabella's traveling wagons of 1485. In 1796, I think it was, Baron Larrey, of the French, who organized the first ambulance company, which was very much like the French field ambulance of to-day. It consisted of a tent section and ambulance wagons. It was considered a great advance. In the campaign in Egypt the baron speaks rather feelingly and says that he prepared to put the litters on camels, but the combatant troops took them to carry ammunition. I think a good many medical officers can say something about that to-day. The next thing was in 1801,

when there was some organization in the French service. Baron Percy conceived a long, sausage-like looking wagon on which were placed saddles. The medical officers rode in the saddles and they placed a thousand dressings and other things in the sausage-shaped body. The Germans about this time woke up and changed their barber surgeons into officers of a commissioned rank. They had regimental surgeons about this time and increased their service. However, there was not a great deal done up to the time of our Civil War, although in the Crimean campaign the French and British sent ambulances to Crimea which did fairly well, but they had no very good organization. The Crimean War was in 1856 or 1859, if I remember rightly. Even at the Battle of Solferino the wounded were not particularly well cared for; and as a result of that the Swiss instituted the idea of the International Red Cross, which was started but got little distance at the time. After our Civil War it was further instituted and worked out quite well in the Franco-Prussian War of 1870-71.

Our Civil War practically gave the impetus to the organization of the sanitary service. We had ambulance wagons before that time; we had them in the Mexican War and in the frontier service in the West, but there was no necessity for any organization other than the sanitary service of a regiment. We had a couple of sergeants and some men detailed from the line for the sanitary troops. At the Battle of Bull Run that situation existed. The Army at the beginning of the Civil War was about 16,000 men. Surgeon General King, at the Battle of Bull Run, was not interested in the management of the sanitary service at all because there existed none. They had some ambulances and a few troops which were the east-offs of organizations. There was a field hospital fixed up, and Surgeon General King spent his time dressing wounded instead of managing the sanitary service, and when the retreat began he states that he followed General McDowell back some distance and then lost him. He was greatly afraid that supplies which he had ordered up might fall into the hands of the Confederates, so he went to Washington to stop the supplies, and when he got there he found they had not been sent. The second year produced some organization, and finally Letterman organized the ambulance company. It was handled by combatant troops that were practically under the control of the quartermaster, and this formed the ambulance detachment pure and simple, and they ran it on this basis for a while, without ambulance equipment, without any sanitary troops or any technically trained personnel with the organization. In 1862, however, Letterman instituted, in addition to the sanitary corps, the formation of divisional hospital units, and they were worked out so that at the Battle of Antietam he had fairly satisfactory divisional hospital organizations. After that battle and the retirement of the Confederates south, in the following winter, the organization was increased and improved very much. In the meantime the armies of the West produced a similar organization, including an evacuation service by hospital train, but no Services of Supply as we know it. So that when Grant went south, across the Rapidan, in 1864, we find that the Army of the Potomac had corps and division hospitals and a reserve medical supply unit very efficiently organized. You remember that the divisions weren't large at that time; they consisted of only between four and eight thousand men, and a division hospital would correspond more or less to our field hospital at the present time, and it worked out fairly well. They had in addition a brigade medical wagon, which corresponded to our camp infirmary wagon. At the Battle of the Wilderness we find the first indication of the use of the station for slightly wounded. At the Battle of Fredericksburg, they found great necessity for the station for slightly wounded, because in December, 1862, we know that the patients who were slightly wounded crossed from Fredericksburg around to the Portsmouth side, where a hospital train was arranged to carry the casualties that had to be evacuated to base hospitals; and they also used boats to carry the casualties, and in fact casualties coming by boat brought the first news of the battle to Washington.

The slightly wounded grabbed all the accommodations on the boats and trains and graver cases did not get out.

On May 5, 1864, at the Battle of the Wilderness, a division hospital was established at Wilderness Junction as a station for slightly wounded and held them for evacuation. Remember the route of evacuation was up north to Washington, and they started their casualties out on the 6th of May, but the Confederate cavalry had crossed the Rapidan and cut the route, and 356 ambulances countermarched and moved down over to Fredericksburg, where a new base was established. They evacuated their casualties there. They kept their patients in the

ambulance wagons 36 hours. On the following days, the 7th and 8th, the army moved down and encountered the enemy at Spottsylvania. A number of the division hospitals, with their patients, were abandoned on the field and the Confederates took the extra rations for the patients for their personal use, and the patients went rather hungry until relief parties were sent to get them.

There was no sanitary service because there was no Services of Supply. The ambulance corps companies having been sent with all their patients over to Fredericksburg, had something like 15,000 slightly wounded, or skulkers, or stragglers. There was no military police service to search out the well from the sick, and any man who could put a bandage on went through. That should not occur, but it has occurred. However, in the present days, with military police, no person should be allowed to go beyond the regimental lines without a diagnosis card or a pass.

Now we have the development of additional sanitary units tactically and on the basis that we had at the beginning of this war. As the Army of the Potomac went south in the Virginia campaign, they found the necessity for these organizations very markedly pronounced, and they describe the necessity for evacuation hospitals. They could not arrange for them in the campaign, but later they organized the evacuation hospital and put it on the railway, so that when Lee retired from Richmond this evacuation hospital, a very large organization, was sent south and stopped at the proper place on the railway and the chain was complete, because base hospitals had been organized at the beginning of the war at Alexandria, at Washington, and other places. Through the West, and all through the East, they had base hospitals but no evacuation hospitals to couple them up, up to this time. They had hospital trains, very simple but very good, at the beginning of the year 1862 and completed their organization well up in 1864, but the first evacuation hospital was in the very early spring of 1865. Now when Sherman made his movement from Chattanooga to Atlanta they had developed the hospital trains very thoroughly; and while they had started out with a corps hospital or reserve hospitals, they finally wound up with division hospitals, which correspond to our field hospitals because our regiment was their brigade, our battalion their regiment, and so on; and when Sherman went south from Atlanta up the sea the transportation factor was very important and their equipment had to be reduced. They supplied the ambulance corps with very light field equipment and moved it. He had only 256 casualties between Atlanta and Savannah. All of these were carried through in the ambulances except the Cavalry, who were dropped off, and the natives were given \$1 gold per day for taking care of them, also a threat that the troops might be along again soon if they didn't take good care of them, and if they expected to have roofs over their heads when the Yankee troops returned the men would be cared for, and they were cared for. After a while the civilians discovered that the soldiers were ordinary individuals the same as they, and they were willing to play the game from a humanitarian standpoint. That was the basis in the Civil War and that is the basis on which the sanitary services of all the armies of the world were organized. We forgot the lessons of the Civil War promptly because we forgot that there was an organization larger than a regiment. We had no necessity for it and lapsed into smaller posts and small operations after the Civil War, usually against the Indians. In the Spanish-American War we went back to the old basis, and then forgot about it after the Spanish-American War. In that war we had regimental hospitals and evacuation hospitals. They were forgotten after awhile. Then some individuals in our sanitary service—two, who have since been retired—commenced to look into our history of war in sanitary service and decided that it must be reorganized. It was, and reorganized on the basis of field service operations, and that is the sanitary service that we have to-day, and that is the sanitary service all armies had prior to the World War which began in 1914. Some semblance to an ambulance company, field hospital, evacuation hospital or casualty clearing station, and base hospital, with means of transportation or transportation by railway or ambulance company or by boat, was brought about. That was the organization, and if you will look into the organization of the sanitary service of the various European nations you will find that the organization is almost identical. You will find deviations in the method of handling it, but you will find that there are similar organizations for all armies in general, and the methods in general of handling the wounded of battle and the sick are practically the same, and the means of evacuation are the same.

Now with regard to the question of war. I think we can safely say that it may be divided into two types of operations—offensive and defensive. With defense always comes the use of natural or artificial features which protect the individual from the effects of weapons, usually trajectory weapons launched by the enemy. In war since the beginning of history artificial features and natural features have been used. The ancient walls and fortifications and the earth and breastworks of the nineteenth and twentieth centuries, and the present trenches, which, of course, have been used largely since the beginning of this century; but they were used long before that. In Julius Caesar's books you see the entrenched camp very clearly, with earthworks and means for the prevention of the rapid advance of the enemy thrown up; so there is nothing new about the use of artificial or natural means for protection, but only in the European war has it been extended quite as far as we now see it. Now the reason why we have the so-called trench operations, which are simply operations in defense, is because we have had on the Western Front armies committed to attack or defense on a field which is protected on one side by the British Channel and on the other by the neutral country of Switzerland. Consequently this position could not be flanked, and if it was well defended by trenches the war is reduced more or less to a state of stabilization. Neither army could maneuver all the force they could gather to attack properly, neither army wished to commit itself absolutely to an overwhelming defeat by throwing all of this force in and taking the consequences. They have made limited attacks at various points and have broken through many times and used up some of their reserves, but neither of them has made a general attack clear through.

Now don't think of warfare as trench operations, as a great many people tried to teach us two or three years ago, saying warfare existed only as trench operations. That is not true. Some few American officers, in fact a great many, who had been in the service for some years, were on duty at the service schools either at Washington or Leavenworth, and they adopted for themselves a doctrine that open operations must begin and must usually end a war. Trench operations are only one incidence of warfare, and the American Army was equipped and trained on that basis, as were all armies prior to 1914, and the American Army still believes, and believes that within the year it has been proven, that their doctrine is correct; that trench operations are simply incidences of warfare, that warfare may be conducted either in the open or in trench; and I think you will agree with us on that now. There are a great many gentlemen who did not agree to that a year ago. Now, if that is the case the organization of the sanitary service must be on the basis of open warfare, and that is what our sanitary service is based on. If we use that as a basis, and it must be, we must have mobility and military economy as the basis of the establishment of our sanitary service and our system of evacuation. We must not think in terms of one casualty and we must not arrange our service for the benefit of a single casualty—that is, we must not attempt to give the single casualty the best treatment, but we must arrange our service to give all casualties the best treatment in the most economical manner. That doesn't mean, consequently, that every single case will get the best treatment indicated by its condition, but that all will get the best treatment possible under the circumstances—the elements of time and distance, the number of cases, and the condition of the many patients. So when you see a single case treated a certain way don't say that is poor treatment from a military standpoint. You may say from the standpoint of the single case it is poor treatment, but we must arrange our sanitary service for the economical treatment and evacuation of all casualties and not always for the best treatment of each individual casualty. Now in absolute cold blood you have to consider the value of the various types of casualties. What is the actual military value of your extensive abdominal wound? Very low, isn't it? That patient is entitled to all that you can give him in the way of treatment, and should receive, but he should not receive it to the exclusion of proper treatment for the lighter case which has the greater military value. Consequently, we have arranged our sanitary service on the basis of rapid evacuation and first-aid treatment for all cases. The question whether the abdominal case should be operated immediately under field conditions or given rest is one for the surgeon to discuss, and probably the military surgeon or the civil surgeon or abdominal surgeon will be discussing that long after we have gone to our fathers. It is a question whether surgical teams should be used to look after these cases early or whether

more lightly wounded cases should not get their look in, because we can dress so many more of them and can handle so many more of them than we can abdominal cases who need immediate operation.

The basis of the sanitary service is mobility and rapid evacuation, because we believe that the chief feature of warfare, whether we are defending or attacking, will be mobility and not stabilization. That being the fact, I think we have no apology to offer for our light equipment in the ambulance company and the field hospital, and that light equipment we should have also in the evacuation hospital. We will get to that later.

Now, for trench operations. When you have gone over the subject of sanitary tactics carefully you will discover that you can use all of the establishments that we have in the division and in the Services of Supply, sanitary formations for trench operations where you are definitely stabilized, and all that is required is an overhead to give the patients the best that can be offered in stabilization, but you must not consider that overhead is any part of the equipment of your mobile organization; that overhead equipment and also, possibly, the personnel must be considered as area equipment and personnel, because in trench operations you do many things from a sanitary standpoint. You organize the sector for the care of casualties and also you organize it on a sanitary basis as a cantonment, and consequently you can use cantonment equipment—camp hospitals, stationary establishments in general. You keep your mobile equipment still mobile and you bring in overhead equipment to arrange for the cantonment feature, either if you are in the line or in the back area.

Now, I think that we have cleared up the points about so-called stationary warfare and mobile warfare. As I said before, there is no such thing as stationary warfare and no such thing as mobile warfare; there are trench operations and open operations incident to warfare. We must have our equipment to cover both. Our mobile equipment will cover trenches when supplemented by overhead personnel and equipment.

The sanitary service over here, and also now in the United States, is as it was before the war, and is organized in general as it is in the Manual for the Medical Department. The control is coordinated, as are all other services and arms of the Army, by the General Staff. With the Quartermaster Corps, the Ordnance Corps, the Signal Corps, Judge Advocate's Department, Inspector General's Department, and what not, all under different chiefs, Artillery, Cavalry, etc., we have had a running fight of it in the United States for a great many years—and the Dental Corps also—and the General Staff had to coordinate. Well, in some cases the bureaus were as big as the General Staff and they had as much influence as the General Staff, and consequently they weren't coordinated. The American Army came over here and each chief—the Medical Department included—wanted to run his own game, as he was looking out always to the interest of his department. We put in a general staff organization which perforce had to coordinate, and that's what they are doing. Consequently the rightful activities of the supply department are controlled by the fourth section of the general staff, and also the evacuation of casualties. Now, the general staff found that this was a wise thing to do, and one day, and most vigorously, the various bureaus were put in the corner out of the way and didn't function. The general staff officer was usually a good man, but it was hard to find a good man who knew it all. They tried to handle it and tried hard; but they had bitten off more than they could chew. So we cut out the bureaus, and the corps chiefs are now coordinating and the general staff is now working out most remarkably well. So if you have a run in with G-1 or G-4 or G-5, remember they are not trying to run your business, they are trying to run the whole army and you are playing on the team, and when you are playing on the team you have to take orders. You can't do it in football, you have to take signals from somebody; and you have to do it in the army. The fullback or the quarterback happens to be in a position where he can cover the whole team pretty well and see what is doing, so we usually make him captain of the team—at least that's the way they did it years ago. We did it that way and that's what the general staff is organized for, to give them a view of the whole situation and coordinate the various units, and G-4 performs this function for the Medical Department.

Within the Medical Department itself, of course, the chief surgeon and the surgeon general control their personnel, unless they have been separated from them in some way for special duty. That don't mean that they can take any medical officer they want and put him in something else. The people he is with are entitled to something to say, I think. A great

many persons think not and that it is advantageous for each corps to look after its personnel and to recommend changes, and if they can secure them well and good, but if the conditions are such that some organization to which they are attached finds that they are absolutely essential they must be given a hearing in the matter to be considered. That is only fair and it is being worked out over here and in the United States. Take, for instance, these schools here. It is essential that the personnel of the service schools, and particularly the sanitary school, should be selected personnel for the work. Now, if the Signal Corps and the various other organizations want to take these officers at any time it will produce a condition that is not satisfactory. Consequently, separate organizations and institutions are protected. Now we will get into sanitary tactics.

To have a knowledge of sanitary tactics one must have a knowledge of the organization of the Army at large, and the organization and capabilities of the Army at large, the relative mobility, the uses for which the organizations are intended, their strength, and their function, and also we must have the same knowledge, and intimately, of the organization of the sanitary service. In addition to that we must have a knowledge, more or less, of military history and tactics; that is, we must have a knowledge of conditions so that in arranging for his sanitary service an officer will be able to foresee an attack or a retirement, or an active or passive defense, according to the conditions. If he does not have more or less of that knowledge and arrange his services on that basis, he will be up against it in a military situation, because few commanders notify their subordinates until immediately before the operation begins of a retirement or a retreat, on account of the moral effect, so that the average medical officer serving with troops must learn something of the tactical use of troops, their methods of attack or retirement, their formation in these functions, and apply this knowledge in the management of the sanitary service or the tactical use of the sanitary service. In order to have this knowledge he must have also a thorough knowledge of map reading and locations by coordinates. His orders will come that way and his information will come in such a manner that he must be able to read a map thoroughly, and also for the purpose of map reading—and in juniors for the purpose of reports—he should have some knowledge of sketching and contour, at least the placing of form lines indicating the locations; that includes orientation and things of that kind. Also, of course, he should have a knowledge of the regulations of his services to begin.

The medical officer preparing for tactical management, say, of the sanitary troops of a division must know his organization, must know the conditions, must exact reports with regard to the condition, and follow up by inspection to verify the veracity of the reports, because reports are not always correct; the other chap may have different ideas on the subject. He must estimate the various medical officers according to their special capabilities and qualities, and everyone is different, and having that he is ready to go to work. He should have as his commanding officer of the sanitary train and his directors of ambulances and field hospital companies the best trained men in the division, besides himself and probably his assistant, and select them also for their control of men and their knowledge of handling their units particularly. Having that, he is ready to go to work. The first thing that he must require in the management of the sanitary service is to know the situation, the general situation, what actually has happened, where the enemy is in general, where our own troops are, whether the division he is attached to belongs to a corps or army; what corps troops there are and what army sanitary troops there are; what divisions comprise the corps and what corps the army; because all that information is going to have an effect on the solution of his divisional problems. He should have an idea of the duties of the corps surgeon with regard to evacuation without the division, because there may be different ideas on the subject. In general, the management of the sanitary service is the same behind the lines, but special army or corps surgeons have special ideas they want carried out. He can get his information at least from the corps surgeon or G-3 or G-1 of the division, because G-1 of the division takes over the duties of G-4, there being no G-4 or G-5 with the division. He then is ready to go to work. He finds out the special situation of the division and insists on having a map of the locality where he is, whether in a rest billet, whether in ordinary marching campaign, marching in contact with the enemy, or in entrenched position or preparing for the assault. He must have a map to form an idea of the country. You can not form an idea of the country

in one minute by looking at the map. The first thing he will probably do is to examine the map for the extent and direction of roads, and he will then study his roads, because the question of the vertical features and roads is very close. He then looks up the position of the troops. Having that information on the map, he looks up the question of camp sites or positions to be occupied.

If on an ordinary march, the division surgeon continues to look about to see what he is going to do to-night. He looks over the water, he looks over the roads, he finds out from G-2 or G-1 where the march halt is going to be; whether there is going to be a noon halt and a night halt; the distance where the camping or bivouac or billeting area is going to be. Having found out those things, he can determine about how many daily sick he is going to have. If the column is marching on a single road or on two or three roads, he must know it, and know how to distribute his sanitary units accordingly, or at least recommend it to G-3 that the march order of the day make such and such disposition of them. It makes little difference what disposition is made of the motor units unless there are impassable obstacles. Remember a division closed up as close as it can be will be 25 miles long, with an advance guard. On a march in contact with the enemy, in order to recommend his disposition of his sanitary units he must know these things. He must have knowledge of the length of any column; he must have knowledge of the road distance of any brigade. He must have all that, and that's what you gentlemen are here to learn. Now what's he going to do on the march? We have introduced the subject with a full field of fire. What's he going to do? If not in contact with the enemy, he will follow the regulations and distribute the ambulances accordingly. You can not expect a man to drop out and stay on the side of the road and wait for an ambulance 20 miles back. What does he do? He follows the regulations and divides his animal-drawn ambulances with the troops. One regiment of Engineers, three Artillery, four Infantry; so he turns out probably two ambulances to each regiment of Infantry and one ambulance to each of the other regiments, and he has practically disposed of his ambulances on that basis. What does he do with his personnel section? He has his bearer detachments and his wagon detachments, and his dressing station parties. If it is an ordinary march, he keeps them with the sanitary train. How does he get this disposition? Probably by written order after he has made his recommendation to G-1 on the subject. He will say, you will have to follow that routine. He reports it to G-3, who issues operation and march orders. So thereafter the division surgeon is notified that the ambulances will be distributed to the regiments on that basis, one marching at the tail of the small regiments and two at the tail of the large regiments. If they are to march on two roads and contact with the enemy is likely to occur, what is expected of each column will depend on how it is arranged. If a brigade is separated in the march the ambulance company probably will march with the motor section of the train attached to that section of the brigade, also a motor field hospital, and probably a couple of camp infirmaries marching with the sanitary train will be told off to move with them, because the regiments may be separated and it may be necessary to send out a camp infirmary with the separated regiments. The equipment is little; one small mule and one large cart, and if you get bad roads, which is possible, you are going to separate yourself from your sanitary cart. I haven't seen a regiment that had one in the operations at St. Mihiel and in the Argonne. They can not run. You will either reinforce them or carry the stuff up by hand.

Now to get back to sanitary tactics. In an ordinary marching campaign, at the completion of the march the ambulances usually stay within the regiments a reasonable time. Usually the order reads, that within 20 minutes after arrival at the camp site the casualties will be evacuated. The surgeon has a line on them, because it is the business of the battalion surgeon to look over the cases and classify them. As to the routine of evacuation: The ambulances will be assembled at a certain point and a motor company will continue the evacuation to the rear. The animals have been on the march all day in the column and by the time they have evacuated their casualties they have done all they can. You can't wear out motors like you can mules; and where you have mules keep them fat. Now how does the surgeon know how many casualties he is going to have? He knows that ordinarily, with seasoned troops, he gets nine-tenths of 1 per cent, and that he will evacuate from one-third. One-half of these will be recumbent and others will be sitting. So he knows how many ambu-

lances he needs. If he has a division of 28,000 men, he will have 1 per cent, roughly, or 280 casualties, and one-third of them will have to be evacuated, and for a factor of safety he can divide them in two and say between one-half and one-third of these cases will go recumbent and the others sitting, and you can figure out that one ambulance company can probably handle them on the basis of each ambulance holding 1 sitting and 4 recumbent, or 9 sitting. One of the sitting can always ride with the driver, and the orderly can ride the tail gate or radiator if necessary. That is the basis of the old division of 20,000 men.

Now the capacity of our sanitary service was arranged on this basis, with a 6-hour period of evacuation and care. Usually it runs about 8 hours, and we figure on giving the sanitary troops at least 4 hours rest every night. If that continued for a year they would get tired, but that's all they get in active campaign. When we boosted our division up to 28,000 men we simply reduced the number of casualties we could shelter and evacuate in that period of 6 to 8 hours about $6\frac{2}{3}$ per cent. Now you take a field hospital on that basis of battle casualties and it works out the same thing. You work it on a basis of 10 per cent casualties. Take the old figures which are given in Straub and they run very low every day. If you are engaged in trench operations your casualties go up to 25 per cent dead and your disposition of recumbents and sitting is proportionate. If you are engaged in open operations, with rear guards with machine-gun fire, as it is occurring now, your casualties are between 14 and 20 per cent; usually about 14 to 18 per cent in the Argonne and in the St. Mihiel offensive, which was there largely machine-gun fire and not much artillery because they pulled their artillery out to save it. In ordinary operations, in open warfare, the percentage given by Straub, taken from Cohen's figures, of 20 per cent dead usually holds. You can work on that and you will be safe. So much for that.

Now the division surgeon having arranged automatically for evacuation by the ambulance companies, he must arrange for the care of patients. If on a railway or waterway he can arrange for the service of evacuation to the rear to come up and take over his cases by train or motor, or boat. He will arrange for evacuation points and will usually choose water or railways or motor service for evacuation service. Remember a division will go into camp or into the trenches with its advance guard well up, and the brigades will be camped in such a manner that it will have a space between it and the outposts so as to favor advance to the line of resistance, favor deployment and occupation of that line of resistance, and the trains will be in position so as to cover all that formation. The sanitary trains will be in their proper position. Now if it is an ordinary march in campaign without contact or a march where contact may be expected, these trains being in the column in their proper position will camp in such position so they can get into the column the next day without countermarching. We will recommend, consequently, according to the military situation, the method of camping the trains, the camp site of sanitary train; the brigades will determine the assembling points of casualties for evacuation, the motor ambulances coming from the division trains, and if the distance is not too great they will probably be continued in that as a matter of economy and are taken over at the evacuation point by the Services of Supply or army service, and he will recommend to G-1 what should be done and he will telephone that to G-1 or G-4 of the Services of Supply or the army to have the Services of Supply or the army service pick up these cases at that point, and he chooses that point according to the military situation, generally choosing a central point to save the transportation. What if there is no evacuation point near? He can do two things. He can bring up his camp infirmaries to cover the few cases in the area, or if they are going to halt a few days he will attach camp infirmaries to them, and also a regimental dispensary, and move his ambulances between the camp infirmaries. If the brigade is separated he will have a field hospital cover that. He moves his field hospitals up to cover them, and they set up as little as possible, according to the indications, to take care of cases until evacuated.

Never set up more of a field hospital than is necessary to shelter and cover the cases until they can be evacuated, when on the march. That's the old doctrine and it applies as much now as it ever did. In open warfare the doctrine is the same as it was before 1914, except that by reason of the road conditions in France, where you have good roads frequently, but always radiating from an axis without parallel lines. Wherever you have a division

attacking on a normal front of 2 or 3 km. you will have only one road. The division is 28,000 men, the artillery is enormously increased over the old, the transportation greatly increased. Attacks are made usually through more or less entrenched areas. The attacks are preceded by large heavy barrage and artillery. You will find roads badly shelled so that they require reconstruction; bridges and culverts destroyed or badly damaged. Consequently in an advance you can not expect, ordinarily, that you will move wheel transportation to any extent; through a zone that has been hotly defended you will not be able to move wheel transportation to any extent before 12 hours. The first to move will be the artillery, and the ammunition trains are a kind of "military necessity," which will be given right of way. You are not to evacuate your patients within 12 hours. Now in order that the surgeon may do débridement or primary suture, he has got to have the patients within 12 hours. How are you going to do it, gentlemen? You are not going to do it, that's all. I haven't seen it done and I don't believe it will be done. What's the answer? It is exactly as you were taught in 1914 and before. Send your bearer section forward as soon as possible after the advance is made. Keep them within a thousand or so yards of the line—not in billets, nor at crossroads, because they might be shelled; send your dressing station party up with equipment on litters, your animal-drawn section and your wheeled transportation up there as best you can.

Now the only wheeled transportation that you can move before this is your animal-drawn transportation because the animals can move the wheeled transportation through some of the holes—not all of them—but you can not move motors through there at all. Now I have gone up with Cadillac cars and tried to go through there, and I think a Cadillac will go anywhere a G. M. C. or a Ford will go; I have ridden Ford cars and I know their hill-climbing ability, but they can not climb out of shell holes. In fact, I saw a Ford tank that couldn't get out of some of them. But you can sometimes get them up by mules where you can not try motors. So if you have animal-drawn ambulances, keep your animals fat and in good condition, and if you have open warfare that's the first you will get up. If you don't you won't get anything up. Now when they get up there what are their orders? The division surgeon will get the usual copy of field order and the administrative order annexed. The field order simply states, as you find in field regulations, what is to happen and not necessarily what will happen, and on that the surgeon bases his plan of operation. If you are attached to an army or corps you will have an army or corps order, which will show where the evacuations will be made. The evacuation hospitals are under the control of the army or corps of Services of Supply. The order will show where they will be, and for the sake of economy they will have various functions. Some hospitals will be devoted to gas, some to special types of surgical cases, some to the moderately wounded; some will be devoted to ordinary sick, and some of them to infectious and contagious sick. They will be distributed according to the plan of attack. The division surgeon, ordinarily, will not have this incorporated in the field order. Nobody needs to know it except four or five persons; the division surgeon, the commanding officers of the sanitary train, and they will transmit that information to the ambulance-company commanders. The field hospitals don't need to know it; they are only interested in the functions they are required to perform.

So far as the management of the regimental personnel is concerned, the sanitary personnel attached to the regiments should be divided into four parts, and enlisted personnel exactly on that basis. A dental surgeon will be attached to each battalion and he will be the assistant to the battalion surgeon and do his work exactly the same as the other medical officer. The battalion surgeon will divide his enlisted personnel into five parties as quickly as possible and attach one party to each company, because, remember, companies are going to attack on a front of about 200 m., if the regiment attacks in column of battalions, so your front will be between 500 and 600 m., and the front of each company in the first line will cover from 200 to 300 m. Consequently you will attach some sanitary troops to take care of the fall outs. That company will attack in depth of 2 platoons in the line and 2 in support, or it may attack with 3 platoons on the line in two or three waves, and 1 platoon back in support. You should cover that company with sanitary troops. On the basis of 48 men you will have mighty few; on the basis of 105 you will have more to allot. All the sanitary troops should do is to dress and group the cases. The battalion surgeon will keep in touch with them and with his

liaison group, replace casualties, and will also look over the nests or groups, and will have a man walk the line of nests that are left as the companies go forward. The regimental surgeon will be with the regimental commander, probably in the second organization, if the regiment is attacking in column of battalions. He will have his own liaison group, his sanitary troops, attached to companies of the second and third battalions. The regimental surgeon will cover the line with his liaison group and reinforce battalion groups as necessary and relieve the sanitary troops that have been tolled off to cover the battalion groups of wounded within the area, which is now 500 yards wide and probably about 1,200 to 1,400 yards deep by reason of the battalions being in depth. You will have men that will have to be dressed and sanitary troops to do it. What are you going to do about establishing regimental or battalion aid stations? The regimental surgeons that I have seen haven't established any. You won't have any equipment except what you carry on your backs or litters and that won't last long. Now there is one thing to do about it. If you can put a pannier on the back of a mule you can take it up before you can get a pack mule forward. The Medical Department packsaddle is too heavy for this kind of work and the size of these mules. What they have done when they went forward was usually to take a sandbag, filled it half full with dressings, and every man carried one. It was quite satisfactory, but the question of establishing aid stations is impossible in these advances. Some of our men, under the influence of trench operations, which will be discussed at another time, have tried it. You shouldn't do it. Depend on your ambulance companies and your bearer outfits to collect your casualties and do the evacuation. Do first aid and group your casualties; leave a man in charge to make liaison with your bearer sections of ambulance companies. That's all you can do. Now with closed roads and the fact that you are not going to move ambulances within 24 hours, as I saw in many cases, means that your bearer group and dressing party must be up early. They must not camp in villages or crossroads, because they get fire. Put them on roads protected by natural features, and you usually find that there is a dugout or something around. But don't be too keen on dugouts unless they are deep, because your friends who have just left them know where they are, and if they don't get you they will get the litter parties leaving there. I figured it out two or three years ago, when I had a discussion with a class at a service school, what possibility there was of a dressing station that was in a trench getting a direct hit, as I found that would take 333,000 shots accurately placed to hit a dressing station located in an area a mile long and half mile deep. When you establish a collecting point get your patients there, warm them up, feed them, give them antitetanic serum, and hope to God some time you will get some transportation there.

The reason why I have taken up the subject of open operations so fully was because a great many in our sanitary service have forgotten about it apparently, although it is well outlined in the publications of the service schools, those excellent publications of General Munson. The sanitary tactics of General Munson and the service schools hold to-day as of old. As I told you before, the concentration of long-range high-power artillery and motor transportation have affected distances somewhat.

Now, so far as sanitary tactics of a division are concerned, with the introduction we have had discussing the sanitary tactics of regiments in advance, which is all I wish to emphasize particularly, I think we can work it out. We have the question of concentration of our men and transportation in the rear, the increase in Artillery from 1 regiment to 3 in a division, the 3 machine-gun battalions, and the increase of the machine-gun company from the old machine-gun platoon, which has increased the transportation enormously, and also the increase in ammunition trains as the result of the increase of the Artillery and machine-gun battalions and companies. So you can lay it down almost as an axiom that in an advance or in pursuit you are going to have material destruction of means of communication, particularly of roads, bridges, and culverts, and you are not going to move your wheeled transportation. Consequently you must think of hand transportation for your sanitary troops and your ambulance company or pack-mule transportation—of course, the latter is much more desirable. With regard to the position of your ambulance company dressing station and bearer detachments in combat, the distances need not be greater than they were in open operations, by reason of the fact that any distance that would give them efficiency would expose them to the same fire from Artillery on account of the long range, so the thing to do under the circumstances

is to put them up in that middle zone between the intermediate batteries' fire and the long-range batteries' fire, which are operated for counterbattery work or interdiction fire against the crossroads and villages. If you will keep your bearers and your dressing station in that intermediate zone you will probably be in the safest place for this detachment. You will have interdiction fire in the rear and there will be a zone where you will be relatively safe, although, of course, some fire will be directed there, but there is no distance within the zone of advance where your organizations can work properly that will not be subject to more or less fire, so in choosing places for the establishment of dressing stations use places away from crossroads and away from villages which the enemy has marked and will fire upon, because troops pass through, and he expects a certain number of them to pass through, so the roads will have interdiction fire placed upon them. Your dressing station under these circumstances will be little more than hand equipment and supplies of drinks and food, hot preferably, for the collection of patients. Now the plan of collecting patients is, you get them off the field and put them in some sheltered position where you can give them antishock treatment; you have some place to sort them, some place to send your ambulances.

Now the question of establishing regimental and battalion aid stations. In open operations I consider them simply as collecting points for casualties. If the regiment is stopped or bivouacked for the night and you can get your wheeled transportation up, the division surgeon may assign camp infirmaries for a regiment which is rather isolated for some reason or other. You may get up your battalion carts and you can use the captured equipment of the enemy, which was done at Soissons. The divisions went into that operation without knowledge that they were going into combat and took hardly any litters. One or two regiments took extra supplies in gunny sacks or sandbags and carried that up. The regiments that did not, fortunately, found supplies, first aid and litters, abandoned by the enemy in their flight. Now there is nothing in the management of the sanitary service except a full appreciation of the functions of the units, and a full appreciation of the terrain and the enemy's fire. Given that and common sense, you can arrive at the proper solution.

Now, with regard to the ambulance company proper, the tactical handling of that. We have discussed the tactical handling of the bearer and dressing station largely. Of course, the bearers have only one function and that is they are the liaison between the regimental sanitary group and the division sanitary units. They must as soon as they are sent up get contact with the regimental sanitary headquarters' unit by agents sent forward. That is not the duty of the regimental personnel. The duty of the regimental sanitary personnel finishes with the rear of the last echelon of that regiment, practically the rear of the combat echelon of that regiment for the time. In an advance they should have nothing more to do than group their wounded, probably in windrows, and leave a man in the sanitary service in charge to walk that windrow and give such aid to the group of wounded as may be necessary and make contact with the agents of the bearer detachment of the ambulance company when they come forward. Having done this, the man in charge should rejoin his regimental headquarters sanitary unit to be used as a replacement or reinforcement later. In stabilization you have exactly the same distribution, except by reason of stabilization you can bring up the camp infirmary equipment to cover the regiment. The regiment will probably be in column of battalions again, with one battalion in the first line of support and outpost first line, one in support position, one in reserve, and one in rest. That is a very frequent formation. Usually the regimental post of command covers the support battalion, and there, usually, there is equipment brought up for a regimental infirmary. It will cover the regiment and serve as a main collecting point for casualties for the regiment. In trench operations the evacuating service need not be tied to evacuation through the regimental aid station.

If it is more convenient to make direct evacuation from the battalion aid station or collecting points, either in trench or open operations, do it. It is a question of common sense, fire conditions, communications, and convenience, and it has to be worked out on that basis. That the regimental aid station is abandoned is not true; that all evacuations must go through it is not true. The regimental aid station would be facultative. If it is necessary to establish it, set up the equipment of a camp infirmary. If it is not necessary, why establish it? It is absolutely necessary many times, for a patient may not be able to get proper first-aid treatment until he reaches the regimental aid station. On the other hand, oftentimes it may be

possible to evacuate a patient direct from the battalion aid station, and in that case it is not necessary to send him to the regimental aid station at all. I think that is the answer to all this discussion about regimental aid stations. Now, the idea of the nonnecessity of the regimental aid station probably arose from the method of handling troops in the British and French Armies. Organizations are largely handled by battalions both in the French and British service, and the regiment is not always a fixed unit, consequently the sanitary service grew up around the battalion, and very properly, instead of around the regiment, and it depends entirely on how we will handle the battalions in our service, whether we will handle the evacuations through the regimental aid station, if it exists, or directly from the battalion. There is no definite, fixed rule about it, so why bother about it? In open operations the regimental sanitary personnel is necessary because it must make the liaison between the battalions and the regiment and the bearers of the ambulance company detachment. It also serves as a reservoir for replacements. If one battalion has a hard time, it is up to the regimental surgeon to send reinforcements up from the regimental aid party, and if necessary from the reserve battalions.

Now with regard to the method of disposition of the ambulance company. There should be no fixed rule for that except this: In an advance it is most desirable to have issued, when it becomes necessary, an order to the commanding officer of the sanitary train, or, if the train has been relieved, an order issued directly to the director of ambulance companies, stating, say "You will cover the first brigade with one or two ambulance companies, according to the terrain, the communications, the probable number of casualties." If one brigade is up and attacking with one brigade in reserve and the zones of advance are definitely fixed, one of them covers a zone which is going to have a considerable number of casualties. The ambulance company covering that one will be supported by another when necessary. If there is no possibility of many casualties, have one company cover it, with the others in readiness to assist if necessary. If the road conditions are such that you believe you are going to have your roads jammed, send them up early. Now the question of road conditions comes up with ambulance companies. In a great many of our operations it would have been impossible to get ambulance company wheel transportation forward for very considerable times, as we have said before. In some operations, where there is an advance over greatly devastated areas, as in a pursuit where the enemy is hurried, it may be advisable to send up with the pursuing brigade your animal-drawn ambulance company, because it can march in the column and motors can't; they must march back with the motor-driven sections of the trains; all animal-drawn transportation must be ahead of it, so that in some cases it is advisable to send the animal-drawn ambulance company well forward and put it in the column where necessary. Then the ambulance dressing station can get in early and your ambulances will be in ahead of the Artillery, or on the road to go in position behind the Infantry, so the animal-drawn ambulances will not interfere with them and they can go forward and pass over obstacles that will prevent the movement of motor cars. Now, there is a general objection to that over here, probably caused by the fact that they were in trench positions for many years and had good macadamized roads so that animal transportation was unnecessary. Under these conditions no one should use animal-drawn transportation; it isn't intended for that purpose if we have motor transportation. Motor transportation is advantageous for many reasons. It moves so quickly that it interferes with directed fire against it, and where zone fire is given your motors can dash through from one place to another before the fire is advanced or moved. In that way it has a great advantage over animal-drawn transportation and also the relative efficiency as to time of evacuation. But we can not dispense with the animal-drawn transportation.

In the St. Mihiel offensive, a medical officer whose services have been recognized and who has since been promoted was very much opposed to the continuance of the animal-drawn transportation in our service, and he stated to me that after on day's advance he had changed his mind and saw the absolute necessity of having animal-drawn transportation. I think we have the amount we should have. We need more in bad weather, but we can not get them on account of the small supply of animals, so we will have to get along with those we have. Animals don't do well over here—they can not get enough forage—but on the whole I think we manage pretty well with them. I notice organizations already calling for pack

animals that were very much wedded to motor transportation before. So I think you will find it will be necessary frequently to send your animals up, and in looking over the axial road, in looking over the probable zone of casualties, you will choose which side of the axial road you are going to send your animal train in according to the communications on that side. If you have roads deep in mud you may get out six ambulances and send them up with four animal teams and your animals can pick their way through. You have only six ambulances going it is true, but you will get something done. Don't try to do long evacuations with them, but simply send them back to your motor head and transfer your patients on the original litter to your motor ambulances. Look over the axial road very carefully and look at the number of bridges and number of culverts, and figure how much damage your artillery fire preparation is going to do, then determine what kind of transportation you are going to use and where to place it. If the roads are going to be jammed and there are some small roads that will not be used on each side of it, beforehand, before your organizations are committed, go to work and fix two assembly points for your ambulance companies at least. If you have to use one on one side and two on the other, do that and put them in position to advance when necessary, so that your evacuations will not be on the axial road but relatively parallel to it and will not have to cross it at congested points at least. So in arranging your field order for the attack, so far as your ambulance company is concerned, if you choose to put that in the field order, and it is sometimes advisable to do so, say simply two ambulance companies at coordinate 2684, one ambulance company at coordinate 68-94. Now, you will have ambulance companies on each side of the axial road, which has been designated in the corps order probably, and you won't have to cross that road probably. You have to work it out on a practical basis, that's all. There is no use to mention distances. Wherever you put your ambulance company, ambulance head, field hospital, you will be exposed to some fire if the enemy chooses to go after that point. What should you do? Avoid points of probable fire, even take points of lesser convenience, but don't in open operations increase your distance as you do in trench operations. When you have your open operations you are doing one of two things; you are preparing to retire and the enemy is concentrating his artillery. In that case you have to be well up to get the wounded back. If the enemy is going to retire he is going to pull out his long-range artillery and he will fight rear-guard actions, and so far as your ambulance company is concerned the distance won't affect it because the range will be short.

Now, what is the function of the ambulance company? First-aid dressing, the collection of patients, evacuation, of care pending evacuation, antishock measures if possible, feeding, and primary sorting. That is, you will sort your cases into about four classes—five, perhaps—you will probably have no dead, or at least few dead, because they will have died at the dressing station; they will not bring dead in there ordinarily. Some other branch of the service will look after that for you. Those able to walk will be classified as able to walk to the post and able to walk reasonable distances. You will promptly start them back as soon as their condition and the firing condition justifies. The sitting and recumbents you will classify; that is, the moderately wounded you will classify under sitting and recumbent, but under the gross classification of moderately wounded and desperately wounded and the relatively nontransportable a case will have an additional classification. Now a nontransportable, of course, will be sent back as soon as his condition permits; all moderately wounded will be sent back as soon as possible; gas cases, ordinarily, will be sent to a special gas hospital, unless army orders, as they exist in the First Army, prevent them. They will be sent to the special gas hospital direct.

Now, with regard to your field hospitals. You have four of them. One of them is used for a gas hospital, depending upon the situation. If the corps order has arranged a definite gas hospital and it is very close up, which it may be in some cases, the division surgeon will not have to concern himself with gas cases. If the gas hospital is not close up, he probably will designate a field hospital in a fairly central position covering the lines of evacuation through the axial road and on each side of it, so it will be near a point of intersection, more or less, which he will designate for gas and special cases, and attach a degassing outfit so they will get prompt removal of clothing and bathing and ultimate evacuation of the gas hospital. That depends on distance entirely, and with regard to the corps order, and if there be any

mobile surgical hospitals near at hand it may be necessary to establish one field hospital as a hospital for nontransportable and attach to it the mobile laboratory and a mobile surgical unit which may have been assigned for that purpose from the corps or army troops. With this distribution made, you have two field hospitals remaining, which will be normally used for the moderately sick and wounded, as a temporary resting place if direct evacuation is not possible to army, corps or Services of Supply establishments, such as evacuation hospitals, which are designated to receive these cases. You will have to cover these two conditions, depending upon your connection with corps and army units. Now, these two field hospitals will also serve as a secondary triage for the distribution of the transportable wounded, according to the special conditions. It may be that army orders, as in the First Army, require the establishment of such a triage. In each case you must presuppose a mobile surgical hospital for care of the nontransportable beyond that, and in that case nontransportables will, of course, go through it.

Your kind of management of the field hospitals depends entirely on the conditions, but, gentlemen, they must be mobile and the ambulance companies must be mobile, because if you start out from the jumping-off place with fixed establishments, such as evacuation hospitals and mobile surgical hospitals, definite gas hospitals, neurological hospitals, hospitals for contagious and infectious cases, venereal hospitals, etc., and you make an extended advance, and these are fixed places, you are up against it. Of course, when you are under stabilized conditions you can have all the refinements and luxuries you want, and you can use them on the first day of an attack ordinarily and you can use them in trench operations. So much the better if you have them, as you are then in pretty much the same position as a municipal sanitary organization. Take any city and that's what you have. Your battalion aid post corresponds to a little police infirmary where cases are sorted and distributed to various places. Then you have little use for field hospitals except to care for the moderately or slightly sick, who will be returned in a few days and who should not get back of the service of the zone of the armies, because if they get back there they will be evacuated to the Services of Supply and you will lose them for months, while if you keep them they will recover in a few days, so that your field hospitals will be used in that case only as a secondary triage, because you must do triage where you have a casualty rate which is congested. Now, if you have local gas hospitals, the question of gas malingering comes up, and I think the ordinary officer ought to be able to tell something about gas. There is an order in the First Army that all suspicious gas cases shall be evacuated recumbent. That's all right; obey the order; but if you have any doubt, put the man on his back at the collecting point and keep him at rest, and if he doesn't require any immediate treatment evacuate the more important cases and he may recover in time.

Now, the question of sorting can not be too much emphasized. It can be emphasized so much it will affect evacuation, but it is very essential nevertheless and should be followed out. We haven't discussed the question of operation of a field hospital company. I have noticed in a good many orders of late that in attack they have been rather hasty in establishing their field hospitals. There is no necessity of establishing a field hospital when an attack begins; you don't know how far it is going, and you are not going to get your cases back to field hospitals within six hours anyway because fire and road conditions and confusion won't permit it. So you have six good hours to get your field hospital put in if the advance is carried forward well. If the enemy has been forced to retire with their artillery, you can tell where to put your field hospitals to get the most number of casualties and to avoid the fire of the enemy. If you put your field hospitals down before the attack begins, you must put them far back. If the attack succeeds, the line goes forward, as it usually does on the first day when you have the element of surprise in it, the field hospital is too far back, and you have to pull stakes and go forward. Don't be in too much of a hurry to establish your field hospitals. Don't establish your dressing stations until you know where and why you are establishing them. Get them up early to avoid interference with the roads. You may have to work off roads, so figure on taking them up by hand or pack mule. Be slow on establishing your field hospitals. If they are mobile there is no reason why you can not have them running in half an hour with trained men. In 45 minutes you will have the water heated and everything going beautifully—no hurry about it. And when the estab-

lishment is moved it doesn't require a general order, it only requires an administrative order covering that one feature, and as I said before there are only four or five persons who have to know where they are—the G-1 of the division, the division surgeon, the commanding officer of the train, and the two directors—and they will notify the ambulances and get connection very quickly. That's all you have to do. Otherwise you are distributing information that is making the patients run all over the country. It is better that the wounded should know nothing about it. They should know the location of their battalion aid post when the organization is at halt or stopped. And there should always be in the field order the location of the station for slightly wounded, and that, of course, should be at the point which drains the line of approach. Now, if your division has gone in on a front of 2 or 3 km.—the distance isn't great—you can usually choose some place near at hand. Don't get it too far back. It should be in front of the field hospitals. The road should be marked and should be patrolled by military police, and there should be a detachment of military police at the point who should have malingerers turned over to them to be escorted back to their commands. No person should be permitted to move beyond this place who claims to be wounded unless conducted by persons that are properly authorized or unless they have a diagnosis tag on them, or a pass. I think in the future patients on foot will be conducted by military police and each will be required to have a diagnosis tag. That will stop straggling beyond that point, and regiments will hereafter have their line of straggler posts behind the reserve battalion. Our troops have gone into these fights not the best trained in the world; they haven't had enough training; they have shown extraordinary initiative and lack of personal fear; but we have had a considerable number of gas malingerers and persons who succumb to feelings of fatigue when they are not; quite a number of loafers and skulkers who are on hand in every organization. It is to be expected of course.

Now regarding the equipment for the station for slightly wounded; it depends entirely on what you have. Ordinarily you have quite a number of camp infirmaries that will not be doing anything. You can soon put it up, and establish that early, because they must be established at the time the attack begins. The British don't call these "walkers"; they call them "runners"; they get in early; they get their diagnosis tag and beat it to the rear as promptly as possible. They go alone and make very good speed, so it must be established early. You can get your equipment from the camp infirmaries. The personnel: If the Services of Supply have handy any sanitary squads, as they usually will, use them; because, remember, a division in entrenched position is living in a cantonment, part of which is entrenched; hence they get sanitary squads, or part of them should be detailed for duty at the slightly wounded station and the rest used as reserve litter bearers. If you haven't this, the most satisfactory organization to make a detachment from is a field hospital because frequently the station for the slightly wounded will have been finished before the strain on the field hospitals begins. This is not as with the ambulance company. The field hospital should ordinarily be used for this purpose, and ordinarily the station for slightly wounded should be on the line of evacuation through which transportable cases pass, and you should have some provision to pass them along. In arranging for evacuation the question is whether it is more economical to send them by foot or bring them down. That has to be determined on the conditions, so it is well to put in the first administrative order, paragraph 4, with regard to evacuation, the method of evacuation, and the route. If they are to be evacuated on foot, let the route coincide with the route of wheeled evacuation of transport cases, so that those that fall out can be picked up by sanitary transportation passing. If it be by rail, or by water, or by motor convoy, it is a different matter. They can usually be pulled through to the next étapes, because their travel will be rapid and they will be cared for; if necessary some sanitary personnel should go with them, but military police should go to prevent the loafing and the looting of slightly wounded that occurs so much en route. No man should move behind the line of the station for slightly wounded without some control, either military police or sanitary control.

Now, with regard to the methods for securing information of the operation and the issuance of these orders. The method of doing this is to make a written memorandum to G-1 and G-3 of the division. After you have secured the information of the operation from G-3 and G-1, getting the details from G-1 of his ordinary evacuation scheme, you will see usually the corps or army orders, or quotations from them. When you get the informa-

tion, prepare a written memorandum, and keep a copy of it yourself. It may be that G-1 or G-3 can not agree with your recommendations, because they have not only to look after the thousand and odd sanitary troops, but they have some 26,000 other troops to look after, so that while you believe you must have the best for your organization, don't always expect to get it, because other outfits have to be considered, and the particular business of these people is to coordinate the demands of all for places, transportation, and roads for the good of the many, and don't be sore if you don't get what you want. Of course, if you get the wrong end of the stick all the time you may have a growl, but at the same time give the other chap a chance to think it over. He will probably recommend that such and such be incorporated in the field order, the station for slightly wounded will be established at such and such a place, say, at "the bend of the road in the vicinity of the big hill." Always use "in the vicinity of" instead of saying "at." That gives the director some leeway in choosing, having regard to terrain, conditions of road, fire, etc. The question of supplies and water figured very much in our sanitary tactics in the past and should be considered now and in the future. But remember it is easy to carry water and fuel, so don't worry about it. A good many times it is a bone-dry proposition, and you will have to bring up your water supply, and you will probably get bad water, because almost all the water over here is bad. Don't always expect to get water and don't figure that all the water you find in the area of operations will be fit to use; because it isn't. It will be damaged in shell holes by mustard gas and by fecal matter and dead bodies. You will have to do lots of chlorination and probably a good deal of settling before the water is much good. So look for protection against fire, etc., rather than convenience and water, food and shelter, and remember that the ordinary cover of houses in villages, as I said before, serves rather to expose your patients to fire; and it is better to expose your patients to the weather than to expose them and yourself, incidentally, to a hot fire of lead and steel.

I think if you make your recommendations in that form you will have no trouble in getting them carried out. G-1 and 3 are not experts in sanitary service, and they are usually looking for your recommendations. You are not asking them for any transportation, because you are using your own, and they will probably adopt your recommendations.

Now the field order. This is usually covered by paragraph 4, which in the field order relates to trains and supplies for sanitary troops. I think ordinarily, if you don't know what to do, the best thing to do is to fix an assembly point for the ambulance companies so they can get it ready and can get to the various points in the zone of operations if necessary; so if you don't know what else to do with the outfits, and you frequently don't, fix an assembly point for them—say, ambulance companies to point 6284; the field hospitals, which are farther in the rear, to another point, so that you can get them out, and then watch developments. Don't go to work and give them fixed positions in attack or pursuit, as so many orders do. Ordinarily you always have time to get them up when it is necessary. When the roads are congested it is well to attach the animal-drawn outfit to the Artillery. Or attach it to troops and then take it away from them when you get up there. The Artillery usually moves with its animal-drawn transportation; so when you know the Artillery is going in, attach the animal-drawn outfit to it and you will have it when you get there, and if you need some camp infirmaries load them on wagons and send them up with the Artillery. In these advances most of the Infantry outfits don't see their medical carts for three or four days. The only way to obviate that is to take the material up by hand or pack mule. You can get him up all right and you can get him over bad places or lead him around them. I think the mule is very necessary. We wanted him before, but the beautiful French roads rather seduced us from the idea of animals, but I think most of us now are quite willing to go back to it. At least I am. I have gone over this matter at rather great length, but some details were necessary to give you an outline.

With regard to trench operations, I want to say that it is a good deal like a municipal sanitary establishment but equipped with mobile sanitary equipment for moving troops. The mobile equipment must be kept mobile for the future advance or retirement. If the troops become stabilized in trench operations, then bring up overhead equipment, which you must not at any time consider part of your mobile equipment, but supplement it with that or, preferably, supersede it with your overhead and keep your mobile equipment packed in

readiness for future use. That means, in the case of a battalion aid party, collecting up all extra dressing, a considerable portion of which will be the larger shell dressings. It means bringing up warming apparatus; it means making dugouts splinter proof; it means extra litters; it means degassing outfits and masks and inhalers; it means entrenching tools for digging trenches and dugouts; and tables, and benches, and bunks. All of these things will be required, but let these overhead things belong to the area and be turned over to the next organization relieving you in that battalion aid station or that regimental aid station, but no part of your rightful equipment if you can avoid it. Keep it mobile, and, where possible keep it packed.

With regard to the evacuation hospital and the evacuation ambulance company, which have been formally classified as belonging to the Services of Supply and really do, owing to the organization and depth of the army and corps they will be normally turned over to the corps for administration, although they are Services of Supply units. In extended open operations it will be necessary to move the evacuation hospitals forward on motor or by rail. As at present constituted they are relatively immobile, without much means of transportation which will be needed for that purpose. Consequently, we will have to organize our evacuation hospitals on the old 482-bed basis, as formerly, in two sections, which will represent the equipment, largely, of the present field hospital, and have a third section for a headquarters and for overhead equipment, which may be drawn up if possible, but, ordinarily, it won't come up until later. Your evacuation hospitals can be brought up and established and their overhead equipment brought up later, such as X-ray outfits and heavier equipment.

Now with regard to open operations and trench operation necessities and equipment, I think we will find our equipment as laid down is satisfactory, except the number of litters. The ambulance company should have at least 150 litters and possibly more, in order to move the casualties from a regiment back to the evacuation hospital on the original litter, and it really is necessary to keep the patient on the original litter at all times. Now if you increase your bearer detachment, as is likely, to 40 litters instead of 20, you will go well beyond the 150 limit even when you consider the 48 on the ambulances. Now at present there is no sort of bed arranged for the field hospital, it being expected that the patient will be brought in on the original litter. Now the number of litters needed by a field hospital is indefinite because it is based on the capacity of the station, but the minimum number of litters in a field hospital, which is being used as a triage and shelter for cases, must be 250. You will oftentimes have above 300, but you can easily expand the field hospital to 300.

I hope that I have impressed you with the fact that our organizations must be mobile for open warfare, and when stabilized we should bring up all the overhead that will make it more efficient and we must keep our mobile equipment mobile and ready for use. If we do not do that we will be in the position of the French during the drive of March 21 and the British at a later date. The British never did become as immobile as the French, because the idea of tactics was not as firmly fixed in the minds of the French as the British. There is nothing extraordinary or wonderful in the work that you are to do over here. It is the same old principle, same old equipment that you have seen in the United States.

Army Sanitary School No. 183.

EVACUATION OFFICER AND HIS DUTIES IN THE ARMY ZONE OF EVACUATION

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The evacuation of the wounded in our Army to-day plays one of the most important parts in our Medical Department, if not the most important one. It is only natural that every medical officer thinks his service or department is the most important, and so it is, and that is the proper spirit. But the evacuation of the sick and wounded soldier is of the utmost importance, not only to himself, but to every department of medicine—and not only to our Medical Department, but to the line, the fighting and combatant troops, for the sooner these cases, especially the seriously wounded, are collected from the battle fields and transported to the surgeons at field, evacuation, and base hospitals, the better condition are these men found to be in. Much less is the chance of infection, and much

more the chance for the patient. And right here is where the surgeon profits, through the early reception of his cases and his having to deal with a contaminated and not an already infected wound, which is the case if patients are not gotten back within the 12-hour limit. Same also holding good with the gassed and medical cases.

So it is my intention in treating this subject to point out only the most important considerations and information necessary for one to know in order to master, handle, and evacuate the sick and wounded in the army, or that zone between the field hospital and your evacuation points, railheads or boats, which in turn carry these men to Services of Supply and base centers, by first passing them through your evacuation and mobile hospitals, which are located in this army zone.

I have divided this information into eight headings, each of which are subdivided, after which I will take up separately each of the headings and its subdivisions and show the reason for knowing and obtaining this knowledge.

1. The army sector:
 - (1) Extent and boundaries.
 - (2) Railroad facilities.
 - (3) Water facilities.
 - (4) Hard and dirt roads.
2. Hospitals:
 - (1) Number of evacuation hospitals.
 - (2) Number of mobile hospitals.
 - (3) Their location.
 - (4) Personnel—
 - Enlisted.
 - Teams, surgical, shock, gas.
 - Nurses, female.
 - (5) Equipment—
 - Capacity beds.
 - Operating tables.
3. Means of evacuation:
 - (1) Ambulance companies.
 - (2) Trucks.
 - (3) Railroads.
 - (4) Hospital trains.
 - (5) Boats.
 - (6) Ambulance convoys.
4. Your plans for evacuation and other evacuation routes:
 - (1) All railroad tracks.
 - (2) Rivers and small streams.
 - (3) Hard and dirt roads.
 - (4) Tram railways.
5. Supply units:
 - (1) Medical supply depot.
 - (2) Commissary.
 - (3) Quartermaster.
 - (4) Post offices.
 - (5) Salvage dumps.
 - (6) Field signal battalion.
 - (7) Red cross.
 - (8) Young Men's Christian Association.
6. Army reserve:
 - (1) Hospitals—
 - Field.
 - Evacuation.
 - Mobile.

6. Army reserve—Continued.

- (2) Surgical and shock teams.
- (3) Nurses.
- (4) Enlisted personnel.
- (5) Ambulance companies.
- (6) Ambulances.

7. Relation with army corps, army corps surgeons, and the disposition of their sick and wounded.

8. Miscellaneous:

- (1) Office and location of the evacuation officer.
- (2) Orders to be issued to commanding officer of your hospitals and ambulance companies.
- (3) Daily reports.
- (4) Data of all casual organizations.

So then let us assume we are entering a new sector for the first time as evacuation officers. The above questions we have asked ourselves, and why must we work out and know the answers and what are the two general considerations to have always in mind while working out your plans and getting this information? First, your wounded; second, their rapid and safe return to the area.

Extent and boundaries.—You must know and study on your map the boundaries and extent of your sector, so as to be able to know approximately how many hospitals will be needed and at what distance they must be apart, as well as to know that they are equally distributed so as to each render the most efficient service and not throw the work on one or two and leave several with little or no work to do, and to learn how many divisions are to your front, what armies are on either side of you, where the high and lowlands are, what railroads rivers, etc., you have access to, and what avenues of retreat are available should such an occasion arise.

Railroad facilities.—The location and what railroads are in your zone and what are these railroad facilities, spurs, sidings, etc. These points should always be picked as close to your hospital centers as possible, and your hospital sites should be picked as close to your railroad as safety, hard and dirt roads allow, and it is practicable. This point also saves traveling and ambulance services. Also you want to learn if there are any sheds or buildings close to your tracks to receive and house your patients from the elements, if there is a loading platform—how much of it is covered, how many litter cases it will hold, and how many railroad cars it will take, for in loading your hospital trains your first patients will oftentimes have to arrive three or four hours before the scheduled arrival of your train, as the average time given by the French railroad authorities to load a train is three hours.

You have also to consider that in a severe push you must have a reservoir or overflow hospital for evacuable patients, and located at railhead, so that the evacuation hospitals can be immediately emptied of those cases that can be moved, while awaiting the arrival of your train, and room made for those not yet treated.

Again, your patients, some of them, will come quite a distance to entrain and have a long, perhaps cold and wet ride; if it rains, these men must have protection and shelter; if there are not buildings enough to accommodate at least 250 patients close enough to railroad tracks, then tents must be erected and personnel obtained, consisting of 6 to 8 enlisted men and 2 noncommissioned officers, in charge of a medical officer, to take care of these stations (the medical officer also acting as entraining officer). The duties of these enlisted men being the same as ward attendants in hospitals, to prepare the soup and liquids and assist in serving them. At the station should be a canteen where your hot coffee, cocoa, broth, and both hot and cold water are always ready; also a light meal can be served the walking or slightly wounded surgical cases.

The equipment necessary at this station should consist of litter racks which hold four litters and enables you to put three times the number of cases in a tent or shelter than if they were laid on the ground, thus saving both tentage and floor space. Benches for your sitting cases, dressings, emergency drugs, a reserve supply of litters (so that any walking cases might lie down and rest if necessary), blankets, hot-water bags and bottles, pillows, bedpans, urinals, lister bags, galvanized-iron cans, medical officers' field web belt, crutches, and maga-

zines. The men all loving to read and oftentimes not having seen a magazine for months, enjoy this pastime, which breaks the monotony while waiting for the train. These magazines are collected when the train arrives and thus used many times. I advise when possible to get the Young Mens' Christian Association or Red Cross to establish a canteen at this station, which means the assistance of several American ladies and the supply of cigarettes, chocolate, fruit, etc. At this station it is advisable to keep your sitting and walking cases separated from the litter ones; for if you don't the former will crowd around those that can not walk and prevent fresh air from reaching them, besides being constantly in the way of attendants and orderlies.

The ideal unit to properly operate an entraining station and overflow hospital is either a motor-drawn ambulance company or field hospital with their entire personnel, the ambulance company being more preferable, having a larger personnel, which can be used to care for the patients, for the unloading of ambulances, and the loading of trains. Then also you have the reserved ambulances to back up a push at the front, and when called on for help by the corps surgeon you can, by ordering the nearest evacuation ambulance company to the place asking for help and covering its station by the one behind it, and so on, move each of the companies in the rear up; keep all your hospital supplied with this important service to the one nearest your railhead, which is covered by the reserve company, and you have done so in one-fifth the time it would require to send your reserve ambulances from the rear clear to the front.

Then you also have several medical officers who can be used and loaned for temporary duty when and where needed, as well as for your boats. If, however, you can not get either the ambulance company or field hospital for this duty, you will then have to get your enlisted personnel and medical officers from one of the hospitals and require each of the hospitals to send a loading detail of so many men on the first ambulances to each train, or both loading the trains and unloading the ambulances. This detail must remain until after train pulls out and they have collected all the litters and blankets and piled them in a place handy to where ambulances unload, so that on their next trip they can take back to the hospital litter for litter and blanket for blanket.

Water facilities.—What rivers, streams, and bodies of water lie near your railheads or in your zone? How far to the front are they navigable? What is the approach to these bodies of water, by hard or dirt roads, railroads and tram railways? What facilities are there for loading boats, such as wharves, bulkheads, docks, etc.? Into what bodies of water do they flow? How long a sail is it to a base center? And what are the nearest base centers to these rivers or waterways? If they can be unloaded from boats to ambulances and taken direct to base hospitals, or must they be entrained? How long a sail is it, and is there room for a reservoir and overflow hospital to be erected as at railhead? For here also will you need somewhat the same requirements and equipment as at railheads, only not perhaps as elaborate, unless boat evacuation is more to be used than rail.

The evacuation by boat is of two great importances: First, in case your railheads and roads are damaged or destroyed you will still have an outlet for the wounded and avoid long overland hauls by ambulance convoys, to avoid congestion and necessitate the using of all your ambulances and taking them away from the front. Second, because of there being no motion, vibration, rough jarring, and swing as on a train, which affords the more seriously wounded, especially brain, abdominal and severe fractures, an ideal way of transportation and much easier than the train. These boats are equipped with bunks or litter racks, three deep; some of them hold 84 lying cases only, others 40 lying and 60 sitting cases, and some 250 sitters only, and propelled by steam. They should have on board coal and alcohol stoves for cooking and sterilizing; blankets, sheets, pillows, towels, field medical and surgical chests, dressings, field mess chest, drugs, Carrel-Dakin irrigators, stands and tubing, bedpans, urinals, hot-water bags, galvanized-iron cans, lister bags, magazines, rubber sheeting, gauze screening, pails, brooms, mops, lamps, and extra litters. There should always be a three days supply of rations on board.

The personnel consists of 4 or 5 enlisted men, 1 or 2 noncommissioned officers, 2 nurses, or 1 nurse and 1 nurse's aid, and 1 medical officer, which personnel I took from each of my evacuation hospitals by roster. It did the personnel good by being both a change and diversion, and gave them a rest on the return trip (but none on the down trip).

The writer has received several congratulating letters from officers and men taking this trip as patients and all were unanimous in saying that it was the most comfortable and by far the best trip yet made by them on this side of the water, and as all of these cases were later carried from Paris by hospital train to southern France, they had an opportunity of comparing both rides.

Hard and dirt roads.—The roads must be studied in your zone and ridden over for you to become familiar with and to learn their general condition and state of repair, to pick out the best and shortest routes from one evacuation hospital to the other, then to your train and boat station, and to learn if there are two or more roads approaching your hospital that can be used as one-way roads for your ambulance companies, thus avoiding a tie-up and the possibility of a serious accident, especially at night, to pick out sites and locations for the possible moving of your hospitals, both forward and to the rear, in case of a sudden advance or retreat, and pick these places with as pleasing surroundings and as much protection, but as close to two or more roads as possible and safety permits, and not down in the lowest hollow you can find; remember it rains, and rains hard at times.

HOSPITALS

What are they—evacuation, mobile, or field—and their number, how many of each kind, who is their commanding officer, where are they located, what is the personnel of each, officers, nurses, and enlisted men? How many added surgical and shock teams has each; what are the numbers of these teams and their personnel, equipment, capacity, beds, and number of operating tables?

You want to know the number of hospitals and their bed capacity to be able when interviewing your corps surgeons, and learning from them the number of troops each has, if you will have sufficient bed capacity to handle a big drive, the class of hospital, whether mobile or evacuation, for the designation of your cases and which can be decided only after knowing their kind, and respective locations; for your mobile hospitals as a rule are entirely for surgery, should be kept as empty at all times as possible, ready for a quick move, they being smaller and used as a mobile unit and moved before the evacuation hospitals are.

Again their locations are important to know; pick out your roads which you have already been all over and are entirely familiar with, and have marked them on your map.

The personnel of each hospital you should know, so as to be able to judge if there is a sufficient number of enlisted men, nurses, and officers to satisfactorily handle and care for the number of beds that hospital has or can crowd, and if there are a sufficient number of surgical teams to handle the operating tables for four hours continuous work; and if not, to be ready in a big push to supply them. The members and personnel of these teams should be known, so should you be called on by one hospital for more surgical teams and immediate assistance you would know which hospital to obtain these from and what teams to call, as the personnel of teams differs, some have 3 medical officers, 2 nurses, and 2 to 3 enlisted men, while others have 2 medical officers and 2 nurses, and some teams have just 2 and 3 medical officers; sometimes you may just want the operators, so would not want to call a team having enlisted personnel and nurses, when perhaps they are being used and much needed at their present location on account of that hospital being short of enlisted men and nurses and not surgeons.

Equipment: You should know if there is anything needed by your hospitals, especially washers, driers, and portable laundries, X-ray laboratory equipment, excess tentage, blankets, cots, bedding, litters, Thomas splints, sheets (which should be used for burying the dead instead of blankets), medical supplies and dressings, and keep behind these requisitions and see that they are obtained, and thus relieve the buck from being passed to you when a big push comes and that hospital is caught napping and without its necessary equipment.

MEANS OF EVACUATION

Has each evacuation hospital attached to it an ambulance company? How many ambulance companies have you, are they motor or animal-drawn, and how many of each? What condition is there equipment in? How many trucks have your hospitals, as you will oftentimes have to call these into ambulance service and you want to know how many are available when you need them. How many United States and other hospital teams you have to call

on. What is their running time from garage to your railheads, and how long does it require to get team to your evacuation point after ordering them?

Boats.—How many of these you will have and their capacity; if necessary, can you obtain more? When, where, and how?

Ambulance and ambulance convoys.—How many can be gotten from the Services of Supply if you should have any accidents or need them as a convoy? Through whom and how are they obtained? What is the shortest time you can get them? And what evacuation base camp or field hospital could you send an overflow to by ambulance convoy; by what routes? The condition of the roads and time for the run must all be known.

Your plans for evacuation.—Your plans for evacuation can now be worked out with the above information at hand. You know your Army zone and zone of evacuation. You have picked your railheads and boat landings and established your receiving and forwarding stations there. You know all your roads and their condition and have marked them on your maps. You know the number and location of your hospitals—these are also on your map—so have your plans for evacuation issued as follows: What ambulance companies are to serve and evacuate each of your hospitals. What roads are to be used for evacuation, not forgetting to use two roads, if you have them, as one-way roads. When these roads have been decided upon, they should be worked by a signboard with the arrow showing direction and the class and number of your hospital, and especially should these markers be at intersections and turns of the road. Another point to note and avoid if possible is having to use roads that are used by truck convoys; these operate mostly at night, as do your ambulances, and that increases the danger of accidents with no lights. And do not route your ambulances over roads subjected to shell fire if possible, even if it will save a little time.

The average time it takes for your ambulance to run from your different hospitals to your railheads must be learned, so that when you order an evacuation from that particular hospital you can figure out the number of ambulances it has and number of cases, lying and sitting, they are to send, how many round trips will be required, and at what time that hospital must start evacuation.

With these plans ready you are now prepared to start evacuation, but should your transportation fail you at any time, or the roads, both dirt and rail, be destroyed, if your line advances very rapidly or something happens to break up your plans, what is necessary?

That you are familiar with every piece of railroad line in your zone, if they are damaged, by having them repaired, would be of benefit to you. What other dirt roads could be used to carry your wounded, or if you could have the labor and material to build you a new road? If there are any small streams running to or very near your hospital and connect with the rivers, you could run your boats on, that patients could be floated down on barges.

Are there any tram railways down, or are there any available that could be used for transporting your wounded, and are there any places advisable that such a road should be laid; if so, see that this is done.

Supply units, medical supply depot; where is it located? If in Services of Supply, how long does it take to get supplies to your hospital on emergency requisitions and otherwise? If there is not an advance depot in your territory, see to getting one at once; this depot should be used only for emergency and supplying those things that the advance stations and the hospitals can not wait for on requisitions. Here should always be kept a large supply and assortment of splints, 2,500 to 3,000 liters, and as many blankets, first-aid dressings, and front-line cases, emergency drugs, Greely tubes, etc.

Commissary, quartermaster, and salvage dumps should be located for your personal convenience, and to inform your hospital commanders where to get these supplies and materials and to forward the equipment often brought by the wounded men and left at the hospitals.

The Red Cross and Young Men's Christian Association, for assistance in your canteen work, burials, supplies, and the many assistances they can give to your men in the field.

ARMY RESERVES

Hospitals.—How many field, evacuation, and mobile hospitals are there that you can call on and how far back are they, length of time required to get them in case of emergency, and your needing additional hospitals, or should one or more of yours be moved away. When

you will obtain your surgical and gas teams for your own services and to lend or assist your corps surgeons, nurses in case of illness or a severe rush; the same for your enlisted personnel.

Ambulances and ambulance companies you never have enough of, and always want more and can always use more. This service is easier and sooner crippled than any in your sector, it having in busy times a serious and perilous duty.

RELATION WITH ARMY CORPS AND ARMY CORPS SURGEONS, AND THE DISPOSITION OF THEIR SICK AND WOUNDED

Relation with army corps and army corps surgeons, and the disposition of their sick and wounded, must be taken up now that we have all data and information necessary to give the corps surgeons, and ready to answer any question relative to evacuation.

Call on and consult your corps surgeons; learn from him or them the location of their battalion aid stations, field hospitals, and ambulance companies.

The names and locations of their division surgeons, commander of sanitary trains, and commanding officers of field hospitals. How to reach them by phone, and where their triages are located; arrange with the corps surgeons to get in touch with at least twice daily—early in the morning and late in the evening, and what ambulance facilities each has; then when a pinch comes you are prepared to lend ambulances and know to where and whom they are reporting, as well as how many to send.

Remember that the strictest cooperation must exist between the corps surgeons and the evacuation officer, and one should keep the other informed at all times of any changes made by the other, especially the moving of hospitals, ambulance companies, divisions, etc.

In your first interview with a corps surgeon you will give him the location of your hospital and evacuation ambulance companies, the roads and different approaches to them, the names and telephone numbers of the commanding officers, so that he can have orders issued in his corps what classes of cases will go to this and that hospital, and see he has designated the two most advanced hospitals for the so-called nontransportable and seriously wounded cases, what roads the various ambulance companies must take in evacuating their patients from his field hospital for the return trip, thus avoiding a tie-up on one certain road and leaving perhaps two or three other roads unused. You should always travel over these roads and become familiar with them in the daytime, for you will have to go over them many times and at all hours of the night, rain or shine, and all ambulance company commanders should be instructed and then see to it that their ambulance drivers are made familiar with them in quiet times.

After having discussed the triage of patients with the corps surgeons, you want to see that each commanding officer of your hospitals named receives a copy of this order, so that each will know what class of work he is to receive and expect, and what to be prepared and equipped for.

You want to arrange with the corps surgeon that he keep you informed of a contemplated attack, the number of battalions, regiments, companies, etc., to be engaged, the time and location of the attack, so that you can estimate the probable number of wounded and the time the first wounded will start coming in.

After you have received all the above information and given instructions to commanding officers and evacuation hospitals to be on the lookout, you should then remain up between your advanced hospitals and the corps surgeons' headquarters, and see that your front hospitals are kept as empty as possible; that there are sufficient surgical teams, personnel, etc.; that the minor preoperatives are directed on back, and that these hospitals have not more than four hours' advance surgical work ahead of them, and when they do, divert your cases that can go to the next hospital and if necessary transfer a less seriously wounded operative case for the more serious one.

You shall notify the commanding officers when advising them to be on the lookout, where you can be reached by phone, and every few hours you should get in touch with your hospitals and be advised as to how many they have coming in, and so as to know when and how many trains to order, as the evacuation officer must take, and be prepared at all times to take, and receive everything the corps surgeons have to send back. These cases must be equally distributed to your evacuation hospitals as far as their wounds will permit of transit, always making it a practice to keep the most advanced hospitals as empty as

possible for an attack and the inpouring of badly wounded, and for the so-called nontransportable cases, and the farther back you get your cases, when just wounded, the nearer they are to your railheads and the shorter the haul for entraining, which saves motor transportation.

The evacuation officer should have a central location and a telephone, with a competent man beside it day and night, to receive messages and be kept in touch with by you from time to time; also, to be informed where he is most likely to catch you at a certain time of the day. The writer usually made his headquarters at his central railhead or a hospital situated near it.

Orders to be given to the commanding officers of your hospitals and ambulance companies are as follows:

First, see that they have a cheerful reception ward, whether it be barracks or tent, well ventilated and heated, located in as pleasing a site, just as close to the road as practicable and safety permits. This site, as well as all locations selected for any kind or class of a hospital, should be picked with the most pleasing surroundings that the terrain will allow.

I always ordered and saw to it myself that there is hot coffee, broth, or cocoa, cold drinking and plenty of hot water for the boys, and for bathing at each receiving ward, along with cigarettes, chocolate, etc. If the hospital has not a lady personnel enough to handle this work, I got the assistance of either the Red Cross, Young Women's Christian Association, or Smith College relief unit ladies to do it for me, for you must bear in mind that some of our boys, in a big engagement, have gone many hours, sometimes days, without food and water, and sometimes both, and they will be some time longer without these things if not supplied them at the receiving wards.

These ladies should be cautioned and instructed by the receiving officers not to give gas patients anything to eat, drink, or smoke, and are told who may and may not have certain things. Here also is where the cheerful voice, kind word, and good figure of a real true, live, interested American woman plays an almost indescribably psychic action on the boys, and a word dropped here and there to let them know how proud they are of them and how proud the folks back home will be to know and see what a wonderful division they are in and how splendidly they fought that the division has now reached such and such a place, all means a very great deal to these boys and gives them new determination and grit (and these ladies know how to do it).

Another very important point to receive attention is not to tie up your transportation at any time, and in order not to do so you must take up with your commanding officers, and see that they always have sufficient enlisted personnel at receiving wards to unload ambulances as fast as they drive up, and to carry these patients into the receiving wards, that they are not grounded outside and kept there for some time.

Instruct commanding officers and see that they always have a sufficient supply and within easy access to ambulances of blankets, litters, splints, and hot-water bags, so that the ambulance orderlies can take back one of each kind of article he leaves with patient, thus keeping each outfit always supplied, whether at the front or in the rear of you.

And the following I get out in writing:

1. Have an enlisted man in road to meet all patients coming into your area from the front. This man is to notify receiving officer that patients are awaiting distribution.
2. The receiving officer will admit all, or such patients as he can receive, and direct driver to take all or part of load to such and such evacuation hospital, giving number.
3. The receiving officer will not admit more operative cases than can be cared for in four hours without notifying the evacuation officer and receiving permission to do so, through his commanding officer.

In case of patients being forwarded, the receiving officer will see that driver understands that patients are not being refused admission and, further, that he knows the road to the hospital he has been instructed to deliver these cases, for oftentimes drivers will be hours in returning to their stations and give as excuses that these hospitals refused the cases, and that one did likewise, and he could not find the hospital he was told to go to, etc.

To your ambulance company commanders that their drivers study the map and roads of both their zone and that of the corps. That they are familiar with all the roads and locations of each hospital, railhead, and boat landing and that you are notified daily of the number of ambulances serviceable and unserviceable.

DAILY REPORTS OF HOSPITALS

The commanding officers must be ordered to see to it that at least three times a day (you naming the hours) you are phoned the number of evacuable cases in his hospital designated below:

Total evacuable -----	Number lying -----	Number sitting -----
Number unoperated -----	Number of beds -----	Total beds -----
Number remaining -----	Contagious cases -----	; lying -----; sitting -----
-----; kind -----	Number of prisoners -----	

The contagious cases report is very important, for each case will take up a section on our American hospital train, and that means three extra beds, so if you happen to have 1 case of mumps, 1 of measles, and 1 of scarlet fever reported from 3 different hospitals, that means you have lost the use of 9 beds, and especially in push times it would be better to hold these cases and transport the wounded first.

Impress upon the commanding officer the importance of starting his evacuation at the time you order it, and never send but just the total lying and sitting you order, and to only send just that, and not to change a sitting into a lying case or vice versa. Our hospital trains will hold just a certain number of lying cases and so with the sitters. When you order a train, you will know its destination and its number; if it is a full train or minus one or more coaches. The hospital commanding officer does not know these things. You figure up this trainload perhaps from four, five, six or more hospitals by their reports, and unless you are sent just that number of each class of cases by them, you are either going to have too many or too few of one class or the other, which is unfair to the wounded man (and no excuse for it), for if too many lying are sent they must be carried back again, and if too few, you are taking a bed from a man perhaps needing an early evacuation to a base, and that train space is wasted.

In making up a hospital train you must consider its destination, for the amount it is to carry depends upon whether it is a short 3 to 4 hour run or one lasting 18 to 24 hours; and if a long one, you do not want to overcrowd it, but see that you have sufficient room for your sitting cases to lie down (generally two in a bunk is figured); if a short one, you can carry many more sitters, they not being obliged to lie down.

Our regular United States hospital train personnel and capacity consists of commanding officer, 3 medical officers, 3 nurses (female), and 36 enlisted men. There are 10 cars for loading patients, each car will hold 36 litter cases, or a total of 360, and in each litter car can be placed 6 sitters. In your cars for sitters you can place 2 sitters for each litter, or 48 sitters and 12 litters, the latter occupying top bunks, with a total of 60 in all, comfortable.

When your train arrives you should have ready the following information for the train commander; and if it is not possible for you to be there, phone the entraining officer what the trainload is to compose, total number, number lying and sitting, number of contagious cases (and what), and number of prisoners. The total number of officers, lying and sitting, should be gotten by the entraining officer after cases arrive at station. All this information should be had before loading begins, in order that train commander will know how many cars to make up for sitting cases.

The data on any and all casual organizations you should know and learn as soon as possible and constantly keep in touch with, most particularly so with engineer and stevedore companies, should you want labor or repairing work done, graves registration bureau for the handling of your dead, and boche prison camps for police duty, and I used many of them as litter carriers and for unloading ambulances and loading trains.

You want to learn the location of post offices and their numbers. If there are any truck companies handy which you can call on for hauling supplies and carrying wounded. Again, these questions, together with the location of your signal, telegraph, and telephone offices, will be asked you many times in traveling your district, and these are things you should know for yourself as well as for others.

Next, the locations of the railheads of the divisions on your front, for emergency rations and other supplies, and as points to use as railheads, should you advance.

Learn what allied armies are occupying the same district; and if any, call on the commanding officer and evacuation officer, offering them your cooperation and any assistance you can, which means you will receive the same offer in return and find it very useful oftentimes.

In closing my paper let me say that it has been my intention to try and bring forth the most necessary essential and important points for an evacuation officer to know and do. However, there are no hard and set rules, except to keep your hospitals empty. Each evacuation presents its problems—the game is not unlike that of chess—you have got to move, and in order to play the game successfully keep things moving. You must be able to expand or contract as the occasion requires.

You have got to visit your hospitals and commanding officers at least once a day. Know and meet the adjutants and officers appointed to look after the hospital evacuation. A good point to keep in mind is always to do your business with the commanding officer or his adjutant, if the commanding officer so desires. But the commanding officer is the most preferable, for when you give an order to him you will know where to place the blame—so does he when things go wrong—and there is no “passing the buck.”

Orders for evacuation, time, numbers lying and sitting to be sent, and keeping of transportation moving, are all very important factors to be carried to the letter.

Each sector presents new points to be worked out, and at no stage of this evacuation game is there much rest, but many rough and dark roads to travel (literally and in reality).

And probably the one point that gave me the most concern was that many men were being sent to the rear with minor, very minor, injuries; some with nothing but scratches, who had at the time thought their wounds more serious; they were picked up and sent to evacuation hospital through channels, which means that they must go to the rear, lose their companies and divisions, and take up the place more needed by some one else, and who would beg to be returned to their commands, but no authority was given these evacuation hospitals to do so, and they had to be sent back.

Likewise a similar condition with medical cases; those that are sick with diarrhea or some condition which means that they are out of the running for perhaps 10 days or 2 weeks. There should be a hospital designated as a medical and surgical hospital to handle just these classes of cases, that would allow the evacuation hospital, when they have this class of case, to transfer it to this hospital and then to be given authority to return the man to duty and to his command when advisable.

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